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AUTHOR Paulson, Steven K.; And Others
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ABSTRACT

A project to assess the range of incentives and programs to establish more extensive research relationships between business firms and the Florida State University System (SUS) is described. The focus was research and development in the high-technology areas. Information was sought on incentives and barriers affecting business-university research and approaches to strengthening cooperative relationships. The following types of information were used: published materials and data; interviews with key Florida industry, government, and university personnel; and questionnaires mailed to samples of high-technology business administrators and university administrators. A literature review and an explanation of the conceptual model for the project (organizational structure and interorganizational relations theory) are included. Among the findings is the point of view of the SUS administrator that the most helpful state action would be to provide research parks, personnel exchanges, and funds. Appendices include the survey questionnaires, information on empirical studies and literature reviews of tax and other fiscal incentives, sections of key Florida and federal legislation for joint university-business research, an illustrative protective agreement concerning research disclosure and review procedures for joint research conducted by Florida universities and business firms, information on types of operating joint business-university research programs, and a bibliography. (SW)

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INDUSTRY-UNIVERSITY RESEARCH IN FLORIDA: INCENTIVES, BARRIERS AND PROSPECTS

A Final Report Submitted to the Florida Institute for Local Government and the Office of the Governor under STAR Research Grant 82-038

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Steven K. Paulson
Robert C. Pickhardt
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Department of Business Administration
University of North Florida
Jacksonville, Florida 32216

September 30, 1983

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Paulson and Robert C. Pickhardt,
Principal Investigators. Donna D. Taylor
Graduate Research Associate.

Department of Business Administration
University of North FLorida
Jacksonville, Florida 32216

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    - To determine if SUS research units and Florida hi-tech firms would become more involved in joint R&D projects.
    - To determine what incentives and facilitating mechanisms can be used to encourage joint R&D projects among SUS research units and Florida hi-tech firms.
    - To determine what forms of joint research relationships among SUS research units and Florida hi-tech firms are possible and feasible.

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Four University of North Florida managers provided encouragement and willing assistance whenever we ran into difficulty, which was often: Joyce Jones, Director of the Division of Sponsored Research; June Holland, Office Manager, Dave Moore, Chairperson, Department of Business Administration; Jim Parrish, Dean of the College of Business.

A crucial aspect of the study was 14 personal interviews conducted with persons who provided up to four hours of their time to talk with us. Their names are given on pages 23-24 of the report and they are thanked for assisting in the project.

The manuscript went through several revisions; if Betty Geitz and Pat Conrad had not provided typing and layout skills, and energy, which went well beyond the call of duty, the report would still be in draft form! Their efforts are very much appreciated.

The Florida Institute for Local Government which provided funding for the project is thanked, especially, for flexibility in allowing project modifications which, we believe, helped to strengthen the research.

CHAPTER I

BACKGROUND OF THE STUDY

INITIAL RESEARCH OBJECTIVES AND MODIFICATIONS

This study was originally designed as a response to a request for a proposal by the Florida Institute for Government through the STAR research grants program. The request was for "an assessment of tax credits for private sector research in the Florida State University System." The activation date for the project was August 1, 1982, although work actually began in early September, 1982. After initial agency contacts and background reading, however, it became apparent that a broader perspective on incentives to do joint research was needed and could be adapted within the original project time and resource constraints. Hence, the project was modified to consider the full range of possible incentives and programs for establishing more extensive research relationships between business firms and the universities of the State University System (SUS).

As a further modification, the project focus was narrowed from "research" in general to "research and development" (R&D) in the so-called high-technology areas. The reason for this change was not only to focus the study on a more manageable area but also on an area believed to be the most critical for economic and educational development in the State in the next few years, as the literature and early agency contacts in the project suggested.

Thus the project objectives, stated as questions to be answered, were as follows.

(1) Should SUS research units become more involved in joint R&D projects with Florida high-technology firms?

The value of answering this normative question lies not only in the potential for developing Florida industries, but also in the potential for enhancing the quality of higher education through improved research opportunities and funding. While some of these evaluative aspects were beyond the scope of the project, per se, this project is seen as a first step in answering this question.

(2) Would SUS research units become more involved in joint R&D projects with Florida high-technology firms?

The focus of the question is on the possible barriers to joint research given that ideally it should (objective 1) produce benefits.

(3) What incentives and facilitating mechanisms can be used to encourage joint R&D projects?

If the "should" and "would" questions (objectives 1 and 2) are positively answered, then this question of incentives and facilitators is relevant as an initial focus for the design of action programs to help establish joint R&D projects.

(4) What forms of joint research relationships between high-technology firms and SUS research units are possible?

Based on answers to question 3, the specific problem then becomes one of identifying alternatives general forms for programs of joint research projects.

The purpose of this report is to provide tentative answers to these four questions. The report, in turn, is based on a multiple-methodology research project which made use of three types of information: (1) published discussion and data; (2) interviews with key Florida industry, government and university personnel; (3) questionnaires mailed to samples of high-technology business administrators and university administrators.

RELATED PROBLEM AREAS

These objectives focus on several problem areas which will be listed and briefly discussed in this section of the report as an introduction to the more specific concerns of the project.

R&D Cutbacks

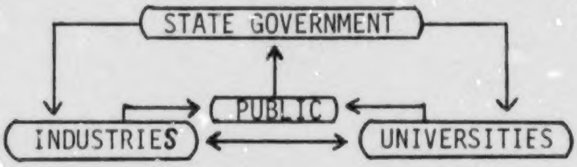
With major reductions in Federal funding of basic research and tuition assistance, universities are looking to state governments and the private sector for support. The private sector, however, has cut back significantly in R&D work in recent years with a resulting reduction in product and service innovation. And it has been argued, in turn, that the public has suffered both economically and socially from the decreased output of university research and industrial R&D. In short, the curtailment in Federal support of university research and industrial R&D has produced a "no win" situation for universities, industries and the general public.

The twin problems of decreased funding for universities and decreased industrial R&D have been extensively documented and were taken as fairly certain assumptions for the research (cf. Meyer, 1978; Hayes and Abernathy, 1980). Manners and Nason (1978) discuss these problems as having a joint origin in governmental policy. In the 1960's, the government supported 40% of industrial R&D but this gradually decreased to 25% in 1978. During this time, government research funding went to universities while industries, for many reasons, became less profitable and more regulated. Since 1978, Federal support of university research has likewise been reduced.

Intersector Relationships

Because of these historical trends, relations between industry and universities have been increasingly adversarial (Levy, 1977; Doan, 1978). A principal dispute is the question of the value of academic research to the needs of industry. Gibson (1977) and Walker (1977) present opposite views; on the negative side are such criticisms as the abstract nature of the research and directors with little industrial experience; on the positive side are such items as the attraction of new business to an area, public service, patent and consulting income and university developed technologies which become adapted to industrial use at relatively low cost.

An alternative to taking sides on this issue, is to focus on joint university-industry work as a mutually beneficial undertaking which also has benefits for the public served by the universities and industries. As a general model, this solution appears to be an "all win" possibility for universities, industry and the general public. Industrial capital stays in the State thereby creating an economic stimulus while developing better consumer products and services. The universities' research programs would be strengthened which, in turn, would benefit the State through faculty development and student research experience. The model thus provides reciprocal benefits through a system of intersector transfers as illustrated below.



Gold (1981) has discussed the economic benefits of such an arrangement to a state which come about as long as the relationship is mediated by a third party such as the state government; she argues that all three sectors would benefit by such a plan, which is a point made by several other authors (Levy, 1977; Doan, 1978; Rahn and Segner, 1976). This seems to especially be the case for "high-technology" areas.

High Technology

As with any recently coined and popularized term, the term "high-technology" is difficult to define precisely. In making reference to this high-technology type of industry, however, a number of general characteristics are consistently cited or implied. The Florida Bureau of Economic Analysis lists the following: (1) a product or service the design, manufacture, or delivery of which involves application of advanced scientific or technological concepts, (2) a rapid rate of product evolution and related high expenditures for research and development as compared to other industries, (3) a high proportion of engineers, scientists, and technicians in the required workforce, (4) frequent development of spinoff technological processes and products which represent potentials for development of new high growth industries or significant expansions of existing industries. (Florida Bureau of Economic Analysis, 1982, 56).

The federal government likewise defines high-technology industries as collections of firms that share several attributes: (1) the firms are labor-intensive rather than capital-intensive in their production processes, employing a higher percentage of technicians, engineers and scientists than other manufacturing companies; (2) the industries are science-based in that they thrive on the application of advances in science to the marketplace in the form of new products and production methods; (3) R&D inputs are much more important to the continued successful operation of high-technology firms than is the case for other manufacturing industries. (U.S. Congress, 1982f, 4)

As an alternative to a general definition of "high-technology" an operational one based on Standard Industrial Classification (SIC) codes is sometimes used. The SIC codes which are usually used as a general boundary for high-technology are SIC 28, 35, 36, 37, and 38. See Chapter III for a more restrictive set of codes.

The Florida Setting

In general, the prediction which seems to be well documented is that Florida will continue to grow. In many ways this growth will attract industry, particularly of the high-technology type. One area, however, which is predicted to be a major limitation on this growth is the availability of adequate (qualitative and quantitative) technical resources to support such growth. A major institution for providing such resources is the SUS which, at this point, is assessed to not be able to provide them either directly to industry, in contractual/consulting relationships, or indirectly through qualified graduates. Hence, the focus of this project is on barriers as well as incentives and facilitating mechanisms to leverage the establishment of joint relationships which could, in turn, promote the growth of adequate high-technology resources in the state.

This position is supported by several sources. A study of high-technology industry location decisions conducted for the Joint Economic Committee of the U.S. Congress (U.S. Congress, 1982f) indicates that the rank position of attractiveness of higher education to firms considering regional relocation is 11th of 12 items for the Southeast, while nationwide it ranked 4th. Nationwide, the first, second and third most attractive items were labor cost/availability labor productivity and tax climate -- areas which were also ranked as being highly attractive in the Southeast. In Part IV of the 1982 annual report to the governor by the Florida Bureau of Economic Analysis, a summary statement indicated that "the need for 'quality' improvement, at Gainesville and throughout the state's universities -- as it relates to support of high-technology industry -- is great." (Florida Bureau of Economic Analysis, 1982, 70) This summary was based on a comparison of Florida with selected other states. Similar conclusions were drawn by the Postsecondary Education Planning Commission which made 15 specific recommendations for modifying higher education to attract high-technology industry to the state. Among these was the following.

"Florida should raise its research universities to preeminence. The presence of such institutions would assure industry of a source for developing the latest technology and for being on the frontier in transferring the newest technology from academe to industry. Such an effort would require more focused use of additional educational resources and would assure high technology industries that Florida has resolved to provide top research and educational support." (Florida Postsecondary Educational Planning Commission, 1982, 109)

The SUS Board of Regents likewise has taken a strong stand on the need for close ties between higher education and industry as the following quote indicates. "It is essential to forge a stronger linkage between the state, the SUS and business and industry if the university research role is to become a primary factor in attracting and supporting high technology industry." (Florida State University System Board of Regents, 1983, 16)

One major constraint on the development of joint industry-university research which has been noted by several authors is Florida's complicated procurement process (Turnbull, 1979; Tuckman, 1979; Thompson, 1979). By focusing attention on such bureaucratic elements, general efficiency as well as joint program facilitation could occur (Levy, 1977). Another major area of concern is the legal process involved in retaining patent rights. This specific focus of Florida laws will be discussed, in some detail, in Chapter II.

OVERVIEW OF THE REPORT

The general objectives stated in this chapter along with the specific focuses on Florida, intersector relations, high-technology and R&D provide the rationale for the remainder of the report. The next Chapter (II) will present a review of the relevant literature and a general conceptual model for the project. Chapter III will present the methods used to gather information which is summarized in Chapter IV; Chapter V will discuss conclusions and recommendations based on the results of the study. In addition to a bibliography, a number of appendices are included in the report which contain illustrations, sample materials and lengthy documents which are not essential to an understanding of the basic literature and methods and findings of the study.

CHAPTER II

REVIEW OF THE LITERATURE AND GENERAL CONCEPTUAL MODEL

One major problem with very current subjects which do not have a history of research, is locating the written materials which do exist. The usual academic journals and books do not contain the relevant information or references to it. This was the case with the current project. Most of the relevant written materials were found in the form of government documents, research monographs, trade and popular articles and unpublished mimeographed reports. Locating these materials became a major focus of the project. Through the Reference Department of the Thomas Carpenter Library, computerized literature searches were made of four different sources: National Technical Information Service (NTIS); Dissertation Abstracts; ABI-Inform; Management Contents. A thorough search of government documents was performed with the assistance of the Documents section of the Carpenter Library. The interlibrary loan program of the Carpenter Library was an essential resource for the project in obtaining copies of materials which are not generally available. Materials were also suggested and, in some cases, provided by interviewees (see Chapter III).

Most of the materials obtained and/or reviewed are brief and have a specific and limited focus. A few, however, are either lengthy with much useful information or brief but have important syntheses or insights. These few sources were frequently consulted and were by far the most influential written materials of the project; these "key" references are listed here with full documentation in the bibliography.

KEY SOURCES

Summaries of State or Regional Joint University-Business Activities

Higher Education and Economic Development in the West (Western Interstate Commission for Higher Education, 1980).

Experiment on Providing Incentives for Industry-University Research Collaboration (Azaroff, 1972).

Analysis of the National Science Foundation's University-Industry Cooperative Research Centers Experiment (Burger et al, 1979).

State Activities to Encourage Technological Innovation (National Governor's Association, 1982).

A Study of the Relationship between Postsecondary Education and Economic Development in Selected States (Arizona Commission for Postsecondary Education, 1981).

Higher Education Resources in Economic Development: A Western Inventory (Western Interstate Commission for Higher Education, 1981).

National Science Foundation Sponsored General Discussions on Joint University-Business Activity

Technological Innovation: The Experimental R&D Incentives Program (Cunningham et al, 1977).

University-Industry Research Relationships: Myths, Realities and Potentials (National Science Foundation, 1982).

Innovation, Entrepreneurship and the University (Kapany, 1978).

Federal Hearings and Reports on Joint University-Business Activity

Government and Innovation: University-Industry Relations (U.S. Congress, 1979d).

Location of High Technology Firms and Regional Economic Development (U.S. Congress, 1982f).

1982 National Science Foundation Authorization (U.S. Congress, 1981f).

Technology and Innovation for Manufacturing (U.S. Congress, 1980d).

Florida University-Business Activity

"There's Know Business" (Jaski, 1982).

Technical Entrepreneurship Task Force Final Doables Packages (Florida Department of Commerce, 1982).

Annual Report to the Governor and Legislature: Part IV High Technology Industry and its Development in Florida (Florida Bureau of Economic Analysis, 1982).

Progress Report to U.S. Department of Commerce Economic Development Administration (Orange County Research and Development Authority, 1981).

1981 Research Report (University of Florida Engineering and Industrial Experiment Station, 1981).

The Master Plan for Florida Postsecondary Education (Florida Postsecondary Education Planning Commission, 1982).

Coordination of Engineering Activities within the SUS (Florida Board of Regents, 1983).

Master Plan of the State University System (Florida Board of Regents, 1983).

Trade and Popular Periodical Materials on Joint University-Business Activity

"Business and Universities: A New Partnership" (Business Week, 1982).

"The Cape and the Kingdom: Florida's Silicon Triangle" (Ward, 1983).

"Research, Innovation and University-Industry Linkages" (Prager et al, 1980).

"Industry-University Collaboration: How to Make it Work" (Azaroff, 1982).

"New Arrangements for Industry-Academic Research" (Doan, 1978).

In addition to these key sources, listed above, other literature was located which is relevant to the project objectives. All relevant literature is classified, and discussed, in this section of the report, or in detailed appendices (IV, V, VI, VII). Of special note is Appendix VII which presents a classification, with illustrations,of actual joint business-university research relationships which have operated within the last few years.

INCENTIVES AND METHODS FOR JOINT BUSINESS-UNIVERSITY RESEARCH

Tax and Fiscal Approaches

In as much as the original objectives of the project focused entirely on tax and other fiscal incentives, the literature reported in this area is more extensive; much of the literature is summarized in Appendix IV. In general, the assessment of tax and other fiscal incentives for encouraging joint R&D is negative (cf. Jacobs, 1979; Cornia et al, 1978; Miller, 1977; Slitor, 1977). Given the already favorable tax climate for industry (U.S. Congress, 1982f)the use of additional tax/fiscal benefits would not appear to have much leverage. Nevertheless, as part of a larger program they may have important marginal influence. Five categories of fiscal incentives for economic growth have been discussed (Cornia et al, 1978; Jacobs, 1979; Miller, 1977) and are listed below.

I. Deliberate efforts to make the overall "tax climate" attractive to industry --

   A. Corporate income tax rate
   B. Personal income tax rate
   C. Property tax -- classified or uniform rate? Does it include machinery, equipment, furniture, and fixtures?
   D. Sales or use taxes

II. Specific tax incentives

   A. Exemptions
   B. Temporary tax abatements, moratoriums, or holidays

C. Tax deductions
D. Tax credits
E. Accelerated depreciation or excess depreciation over "true" depreciation on buildings or other capital goods
F. Incentives for establishing plants in areas of high unemployment
G. Deferrals

III. Industrial development bonds

A. State, city, or county revenue and/or general obligation bond financing
B. State, city and/or county loans for building construction
C. State, city and/or county loans for equipment and machinery
D. State loan guarantees for building construction
E. State loan guarantees for equipment and machinery
F. State financing aid for existing plant expansion
G. State matching funds for city and/or county industrial financing programs

IV. Direct Cash Grant

A. Demonstration projects
B. In exchange for equity with option to repay
C. As matching

V. Special services

A. State-sponsored industrial development authority
B. Privately-sponsored development credit corporation
C. State, city and/or county owned industrial parks
D. Extension of water and sewer facilities to a new industrial location
E. Assist in formation of venture capital association
F. State assistance in finding suitable plant sites, developing new production techniques, and offering free technical training for prospective employees
G. Development of research parks
H. Establishment of a clearing house for transfer of technological advances
I. State help in bidding on federal procurement contracts
J. State, city and/or county financed speculative building

Florida's major tax policies and incentives are summarized below; for more details see the section on legal aspects later in this chapter and Coopers and Lybrand (1981).

I. Florida Corporate Income Tax

5% of net income
Exemptions -- Subchapter S, Corporations and Domestic International Sales Corporations

II. Personal Income Tax -- None in Florida

III. Property Taxes in Florida

- A. Includes -- land, buildings, fixtures, and other improvements
- B. Exemptions -- inventory, freeport storage
- C. Mineral, oil, gas, and other subsurface rights are assessed separately
- D. A 1980 constitutional amendment passed permitting counties and cities in Florida to grant new and expanding businesses up to a 10-year property tax holiday (excludes school millage)

IV. Florida Sales Tax

5%; R&D costs of product manufactured are exempt

V. Florida Tax Incentive Credits

A. Economic Revitalization Incentive Credit -- allowed for new, expanded, or rebuilt business in an enterprise zone if five or more jobs are created for residents of the area. Credit is allowed for ten years ($50,000 maximum per year, expires 12-31-86)

B. Jobs Creation Incentive Credit

25% of actual monthly wages (maximum $1,500 per month for 12 months), paid to new employees residing in an enterprise zone (expires 6-30-86)

C. Community Contributions Credit

For contributions made to revitalization projects undertaken by redevelopment organizations (50% of contribution, $200,000 maximum, expires 6-30-86)

Legal and Legislative Approaches

The legal environment for joint university-business research is an important area for facilitation and incentives. Perhaps the most widely discussed area in terms of controversy and concern is that of patent rights. "Theresults of a 1980 survey of University Associated Research Centers (UARC's) revealed that 53% of the contacted UARC's stated that patent rights are negotiated on an individual basis. Thirty percent of the research centers retain sole possession of the patent, fifteen percent indicated that the client firm holds the patent right, and six percent stated that joint ownership occurs. Sixty-three percent of the UARC's require the right to publish all research results." (Hise, et al, 1980)

As T. F. Jones, Vice President for Research at MIT indicates:

> Universities generally support institutional patent agreements, not because of potential return (which is minimal) but because of their value as effective instruments for technology transfer....Experience shows that it often costs orders of magnitude more to transfer a basic university-generated invention to the market place than it did initially to invent it. It follows that the transfer of technology takes time, requires specialized expertise, and costs considerable amounts of money. To encourage industry to spend this time, effort and money, it is often essential to offer prospective licensees sound patent protection, coupled with reasonable license terms...The University's ownership of patents and ability to negotiate reasonable licenses consitute, I believe, a major inducement to this technology transfer....We are learning that the licensing process draws the research university closer to industry, which everyone recognizes to be a desirable goal. (U.S. Congress, 1979d)

A similar view was indicated more recently by George Keyworth (1982) who has been the director of the Office of Science and Technology Policy in the executive branch of the U.S. Government:

> One area of Government-industry-university cooperation in which we are making additional progress these days is that of patent policy. This is crucial to this three-way relationship and to the whole matter of stimulating industrial innovation. If we are to encourage new ideas and new inventions, and their development and marketing, we must be concerned with means of stimulating and rewarding creative people. (Keyworth, 1982)

These views are different from earlier more optimistic, laissez faire ideas (cf. Miller, 1974). A major problem is that over 25 different statutes control Federal patent policy alone. When added to other statutes which might be relevant to university-business joint research, a major barrier of legal confusion may result. Some of the more important Federal and Florida legislation is provided in Appendix V.

Joint Coordination Approaches

In addition to financial and legal incentives or facilitators, a major area of discussion is the use of coordination through joint university-business committees or third parties such as the state government. Such arrangements, although quite variable in emphasis, have several common characteristics (cf. National Governors' Association, 1982): joint membership by university, business and government leaders; primary purpose is to conduct research in order to make recommendations concerning possible research projects or areas for joint research; promotion of education and business sectors to scholars and/or firms outside the state. Funding of these programs is in a variety of forms from member contributions and matching state with private funds to total state and federal funding. Swalin (1976) discusses the Minnesota Institute of Technology Advisory Council which has been cited as an important prototype of this approach to developing joint university-business relationships. This council was formed in 1972 and has a membership of 21 persons with 3 year terms. The membership includes senior technical officers for industrial organizations and representatives from state and local governments. The University of Minnesota's Assistant Dean for Industrial and Professional Relations acts as the executive secretary of the council. The California Commission on Industrial Innovation, another often cited example, is state funded and composed of 18 members similar to the Minnesota group although the Executive Director is appointed by the governor. The commission matches industrial research grants to universities. Other illustrations of the joint coordination approach are provided in a National Governors' Association (1982) publication.

A major proposal of this type for Florida, which would focus on engineering is being promoted by the SUS Board of Regents and makes use of two resource organizations already in place: State Technology Applications Centers (STAC) and the Florida Engineering Education Delivery System (FEEDS). These two organizations along with the Florida Department of Commerce and the SUS Divisions of Sponsored Research would be coordinated through an industrial/academic council (see Florida Board of Regents, 1983).

Another major "coordinating" approach is through the development of research parks. In Florida, enabling legislation was passed in 1978 (see Appendix V) which established the Florida Research and Development Commission which reviews applications for park development and approves tax-exempt industrial revenue bonding for construction. The general idea is that the park would be located near a university and that non-manufacturing research and development activities would be conducted by industrial tenants, making use of university expertise in contractual, exchange and other arrangements. A local advisory group, appointed by the commission would be the policy setting body for the park. At this time, four such parks are being developed in Florida (Tallahassee, Orlando, Gainesville, Tampa). The first such park was developed in 1951 at Stanford University. In 1971 a survey of research parks showed that of the 81 parks which had been initiated, 25% had survived (Carter, 1978). Currently about 23 such parks are operating in the U.S.

As an initial step toward developing such coordination efforts, faculty-business researcher exchanges have been suggested as a natural extension of private consulting agreements already existing between business and university faculty (National Science Foundation, 1982).

A very elaborate model of the university-business research facilitative center has been developed by Boykin and Diaz (1980:302-304). Each of the six relationships in their model are described on the following pages.

CENTER TO INDUSTRY

- foreign technology information
- domestic nonproprietary information
- patent searches
- information on world market/national market/ trade restrictions/sales methods (available from another national center devoted to such information)
- economic/technical evaluations of new developments for small business and inventors
- funding for device and prototype subsystem development
- new business venture management organization
- clearinghouse for university faculty work in industry
- rental of laboratory/staff to industry
- sale of system simulation time to industry
- evaluate/develop technical ideas

INDUSTRY TO CENTER

- personnel and report/information to keep Center personnel current
- funding for cooperative development
- completed prototype hardware for evaluation (and after sufficient proprietary period, instruction)

UNIVERSITY TO INDUSTRY

- graduate employees
- research results
- part time researchers
- library
- general purpose computers

INDUSTRY TO UNIVERSITY

- cooperative agreement funds for basic research
- research needs
- adjunct professors
- lecturers
- realism
- synergy

CENTER TO UNIVERSITY

- information on industrial technology need
- grants for basic research (in cooperative agreement with industry)
- cooperative use of laboratories
- prototype development of device invention
- adjunct professors as reservoir of knowledge and to absorb supply/demand fluctuations
- lecturers
- clearinghouse of new foreign/domestic technology
- cooperative educational opportunities

UNIVERSITY TO CENTER

- part time researchers
- library facilities
- general purpose computers
- basic analytical/experimental research
- graduates/employees

Through the National Science Foundation, three such multiple-university/multiple-business cooperative research centers have been established using Federal and industry support for joint R&D (Burger et al, 1979): New England Energy Development Systems Center through the Mitre Corporation; Furniture R&D Applications Institute through North Carolina State University; MIT-industry Polymer Processing Program.

Needs Assessment and Inventory Approaches

While coordinating approaches tend to focus on all three sectors (industry, government, university) as being relatively equally involved or on industry-university relationships without government assistance, the ideas discussed in this section all focus on the state as the major actor. The most frequently mentioned form is that of the state providing (1) a research needs assessment and (2) an inventory of university personnel and physical resources which are available. The Florida Postsecondary Education Planning Commission (1982) has strongly favored this approach as they indicate:

> The Department of Education should establish an office at the State level to act as a clearinghouse for information on Florida's postsecondary education programs of value to the State's economic development. This office should maintain information on the work and expertise of Florida faculty in public and independent institutions. It would also prepare data on the quality and number of postsecondary education programs in areas critical to economic development, identify programs of excellence, and compile statistics to be used by economic development recruiters to improve the perception of Florida's postsecondary education capacity....A computer-based registry of faculty and staff with expertise in areas of high need by Florida business and industry should be compiled in conjunction with the public and independent universities and the Department of Commerce. This registry should be in a clearinghouse.
> (Florida Postsecondary Education Planning Commission, 1982: 106-110)

The Technical Entrepreneurship task force of the Florida Department of Commerce (see Florida Department of Commerce, 1982) has likewise endorsed this idea. L'Esperance and Hunker (1979) have recommended similar ideas for Ohio as part of a larger effort to communicate industry needs to universities and university capabilities to industry.

Educational Quality and Capability Approaches

Many suggestions for methods and incentives to bring university and business together to do joint research focus on modifying the university structure and/or making it attractive to firms of a particular type -- in the case of this report, high technology firms. Under the general heading of educational quality, then, a number of the more popular approaches will be reviewed.

The development of entrepreneurial programs to encourage high technology business growth has been an important part of the Massachusetts Institute of Technology's program for a number of years (U.S. Congress, 1979d) and has been discussed as an important focus for development of attractive educational programs in the western states (Western Interstate Commission, 1981). The Florida Department of Commerce has promoted the development of such entrepreneurial programs through a task force which has made two recommendations: (1) develop decentralized sources for managerial assistance for the high technology entrepreneur to include both early venture development assistance and business planning assistance; (2) encourage development of management courses for perspective entrepreneurs.

Another "method" recommended by the Florida Bureau of Economic Analysis (1982:71) and the Florida Postsecondary Educational Planning Commission (1982:109) is the improvement of university faculty. A similar call by these groups has been made for increasing the "quantity" of Florida faculty, particularly in the engineering fields which are severely under supplied (Landis, 1977:401; Western Interstate Commission for Higher Education, 1980:22). An extensive agenda for adding to the supply of engineers was developed at the National Engineering Action Conference and is included in the hearings on the 1982 Engineering and Science Manpower Act (U.S. Congress, 1982a). Included in such recommendations is the suggestion to make rewards (salary, rank, tenure) consistent with hiring and keeping highly qualified faculty. Swalin (1976:25) emphasizes the problem in such a plan is that it can lead to long-run faculty obsolescence. The use of endowed chairs in engineering or other fields where the expected interaction with industry is great is a mechanism which might be used to attract quality faculty, either State or industry funded or a combination. It should be mentioned that when compared on several indicators of quality, Florida engineering programs rank fairly high (Bureau of Economic Analysis, 1982:69).

Another major approach which can be taken to improve the capability of universities in working with business on R&D programs is through the establishment of a university administered office of university-industry relations. A similar approach would be to focus university associated research centers on private sector needs. In 1980, a survey of 487 of these centers (Hise et al, 1980) concluded that underutilization is due to the lack of awareness by industry of the availability of such centers. The MIT industrial liaison program is a fully developed example of such a center which is supported by university funds as well as a consortia of business firms who have special access to research information. At least four universities have focused research centers on the area of entrepreneurial innovation (cf. Kapany, 1978): Center for Entrepreneurial Development at Carnegie-Mellon;

The Innovation Center at MIT; Experimental Center for the Advancement of Innovation and Invention at the University of Oregon; The Innovation Center at the University of Utah. A common and apparently critical characteristic of these centers is the multidisciplinary nature of their personnel and project groups. (Swalin, 1976) This characteristic is contradictory to the idea of enhancing faculty quality in very narrow areas and may be further confused by industrial hiring patterns as Azaroff (1982:32) indicates: "although industry pays lip service to its desire for broadly based generalists, what it seeks in campus interviews are specialists who can step into rather narrowly drawn job descriptions."

BARRIERS TO JOINT BUSINESS-UNIVERSITY RESEARCH

The discussion of alternative incentives for, and methods of, doing joint work is incomplete without a review of the "barriers" which such incentives and methods would attempt to overcome. This section of the report will present some of the barriers which have been discussed. There is no shortage, in the literature, as to ideas about such barriers; several authors have provided useful, and similar, listings. Burger et al (1979) describes five barriers.

1. cost — particularly for small companies that operate on low profit margins.
2. patent rights — the practice of the Federal Government to retain patent rights to Government-financed inventions.
3. publications — the conflict between the right of university researchers to publish and the proprietary interests of industrial firms.
4. utility of university research — the perception by industry that university research is of little direct value to industry.
5. approach — the apparent mismatch between the discipline-organized university and the mission orientation of industry.

(Burger et al, 1979:4)

Azaroff (1982) describes four barriers and compares industry and university positions: publications; patents; job performance; general attitudes. Azaroff goes on to describe, for each of the four areas, how compromise might be realized. Another, similar, listing is given by Prager and Omenn (1980: 207-208) which includes the following: basic vs. applied; long term vs. short term; publication vs. confidentiality; company vs. research goals. These discussions, as well as other literature on barriers will be summarized in this section of the report under five headings.

Low Expected Returns

Boykin and Diaz (1980) summarize this barrier of low expected returns as it exists at the national level.

> As long as there is plenty of federal funding, the excesses of bad planning and coordination can be overcome by the use of resources to overcome hurdles. With limited funding, more knowledgeable and effective planning is essential.
> (Boykin and Diaz, 1980:299-300)

These authors have developed a set of cost criteria for use in evaluating a specific joint business-university research effort which are as follows.

> 1. Maximize the synergystic effect of interdisciplinary cooperation
> 2. Minimize Government purchases of items
> 3. Maximize the useful technology of devices/production
> 4. Minimize time to production of new products/machines
> 5. Maximize availability of laboratories to industrial/university partners in useful developments
> 6. Minimize paperwork/bureaucratic levels
> 7. Maximize value of technology assessment
> 8. Maximize university research productivity
>
> (Boykin and Diaz, 1980:308)

A number of authors point to the substantial returns that can be realized (Gibson, 1977; Dohrman, 1982; Landis, 1977; Azaroff, 1982). Prager (1980) summarizes much of this material on potential benefits as follows.

> Perceived benefits for universities include:
>
> — potential for long term research support less entangled in red tape
> — help from industry in making new technology more commercially useful
> — provision of broader experience, industrial exposure, dissertation topics, and potential employment opportunities to students
> — stimulation of faculty through interactions with industrial scientists and through access to specialized industrial equipment
>
> Potential benefits for industry include:
>
> — additional sources of ideas, technology, and knowledge
> — ability to draw upon competent scientists without expanding in-house capabilities
> — high benefit/cost ratio when compared to building an in-house research unit
> — source of potential research employees sympathetic to industry needs
> — stimulation of industrial scientists and engineers

Little Interaction and Communication

As several authors indicate,(Landis, 1977; Western Interstate Commission on Higher Education, 1981; Prager and Omenn, 1980; Fusfield, 1976) there is a long history of non-interaction between business and higher education hence both sectors are unaware of the resources, needs and constraints of each other. Boykin and Diaz (1980) discuss this problem and offer a comprehensive solution in the form of an industry-university cooperative center, as discussed in the above section.

Secrecy and Publication

Under the earlier section on legislative approaches to encouraging joint university-business research, the issues involved in patent and publication rights were discussed. Azaroff (1972), Landis (1977) and Prager and Omenn (1980) describe the contrary needs of business (to keep research findings secret) and universities (to publish research findings) as well as the economic issue of which party will hold the patent on new processes and products. The MIT/Exxon corporate-university relationship has been highly criticized for the unusual privileges granted to Exxon: "an irrevocable, worldwide, non-exclusive, royalty-free license under all sole and joint contract patents without accounting to MIT" (Crittenden, 1981). The arrangement also gives Exxon the right to review proposed reports prior to publication and the right to delay publication up to 90 days if Exxon decides to apply for patents; the deputy director of the MIT lab indicates that these are standard clauses in research agreements with other firms (Crittenden, 1981). A similar but less restrictive agreement has been developed and used by researchers at the University of North Florida (see Appendix VI for a modified illustration).

Limited Resources

A number of resources which would be desirable, if not required, for joint research work are not widely available, especially in Florida. One such resource is risk and venture capital and it is not as available in Florida as in some other states (Florida Bureau of Economic Analysis, 1980). Entrepreneurs and talented managers, on the one hand, and scientists, technicians and engineers on the other, are likewise in short supply generally (Keyworth, 1982; Landis, 1977). Faculty workload can be a major barrier (Landis, 1977) as can the lack of university research facilities (Keyworth, 1982). In a similar way, the quality and reputation of faculty can be a major barrier as, in general, they seem to be in Florida (see "The Florida Setting" above).

Organizational Differences

Perhaps the most difficult barriers to university-industry joint research are the generic structural ones. Universities, for example, are highly decentralized with a noticeable lack of control devices (Landis, 1977) which could be expected to produce greater variability among individuals' performance than among counterparts in industry which is more centralized with more control devices. Another fundamental organizational difference is the profit orientation of business (Prager, 1980) which tends to force a narrower goal orientation and a greater need to justify R&D expenditures in terms of concrete and shortrun outcomes (U.S. Congress, 1979d). Alternatively, the focus of universities is on education and basic research (Landis, 1977). Prager and Omenn (1980) compare organizational differences which restrict interaction.

> Universities are reluctant to enter into long-termed, detailed agreements with industry for fear of compromising academic freedom and jeopardizing federal funding of related research...[While]...industry is responsible to its stockholders; its bottom line is financial viability and profits; the goal of its research is new improved products. Industry research is run by upper management in direct support of the company's interests; management sets objectives and directs the research.
> (Prager and Omenn, 1980:380)

Attitudinal Differences

As a result of the five barriers discussed thus far, as well as ideological differences, the attitudes of industry and university researchers tend to be mutually skeptical. And such skepticism can result in stereotypes which reinforce suspicions. During the past fifteen years, this process has resulted in many relationships becoming openly hostile (National Science Foundation, 1982). As Azaroff (1982) indicates,

> Ancedotes abound about professors who have other priorities (teaching, other research projects), students who have little interest in applied research and, probably most critical, assignments that are not completed and reports that are not submitted on schedule --- industry has accumulated a string of bad experiences at universities that make it even more reluctant to initiate new ventures.
> (Azaroff, 1982:32)

And faculty likewise have their biased view as Landis (1977) indicates:

> The average age of engineering faculty members is in the mid-forties, and the average age is unlikely to decrease. The situation is aggravated by the fact that universities have a fairly strong "trade unionism," whether formal or informal. As a result the full acceptance of professionals from industry frequently becomes difficult.
> (Landis, 1977:321)

THEORETICAL SOURCES AND GENERAL CONCEPTUAL MODEL

While most of the literature reviewed for this project was problem specific, the more general guides to conceptualizing the project were from the literature in organization theory, specifically those which deal with organizational structure and interorganizational relations (IOR). That is, the focus on university-business-government research relationships is conceptualized as interorganizational relations. While this is not a widely discussed approach, it has been recommended by the National Science Foundation (1982a):

> University/industry interactions represent one of the more useful areas in which to apply concepts of interorganizational relations as they relate to innovation processes. Universities are seen by many as a critical source of basic knowledge which in turn gets translated into innovative products and processes by industrial performers. Industrial firms are users of scientific and technical information, and understanding is needed about how information gets disseminated to and used by them, and what role is played by academic research in the process.
>
> There is evidence that the degree of goal similarity and compatability is related to the amount and success of interorganizational interaction. In addition, interorganizational exchanges typically do not involve an entire organization, but are transacted in "boundary spanning units" on an organization's periphery. The structure of such boundary-spanning units, and the organizational incentives and rewards for participants in such groups, may be important determinants of interorganizational behavior.
> (National Science Foundation, 1982a:6)

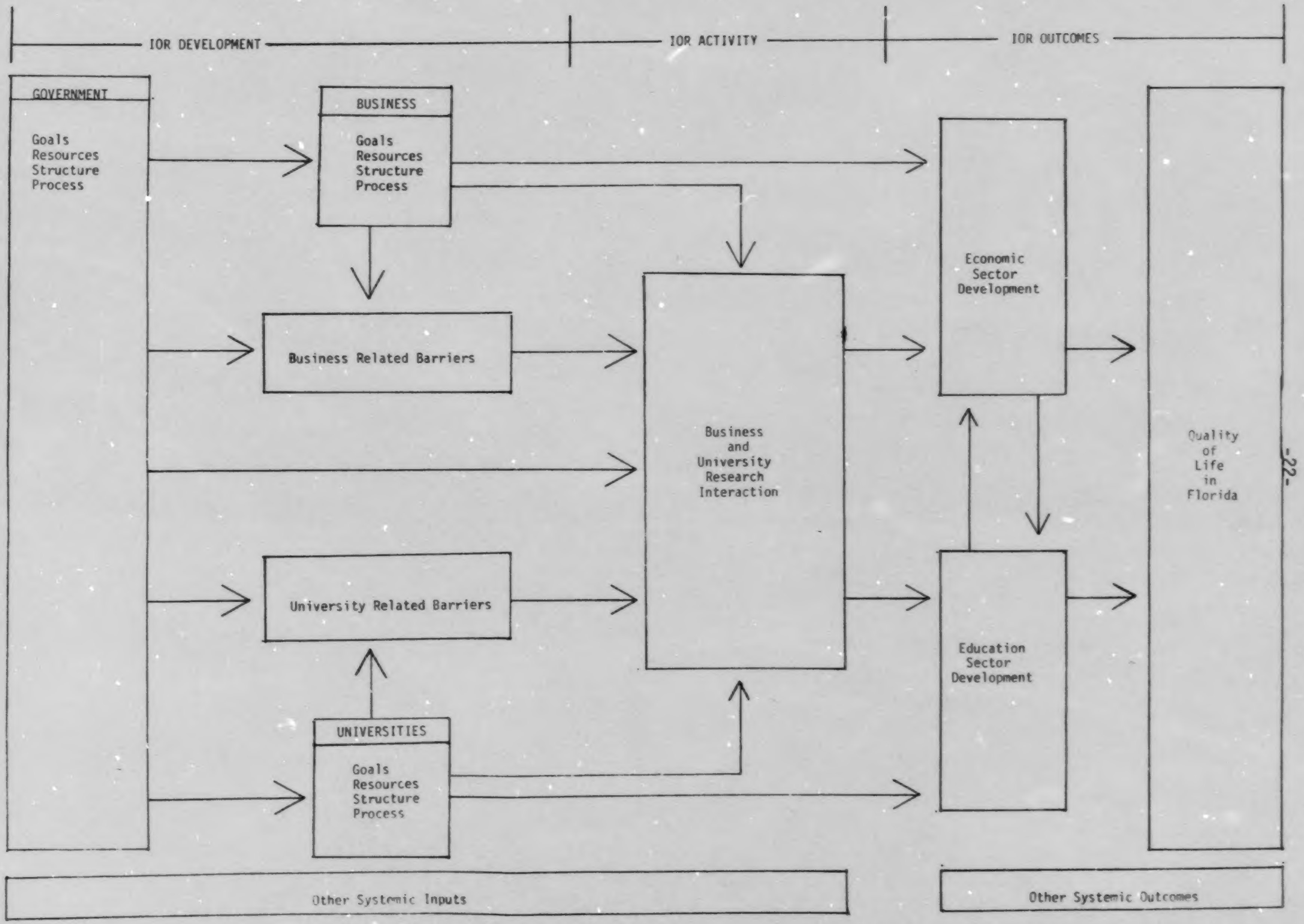
Bringing these two areas together, then,represents an additional objective and expected contribution of the research. Two major processes which occur in IOR are exchange and dependence (Aldrich, 1979:266-268). One general proposition is that organizations strive to obtain what they need through mutually beneficial, or symbiotic, exchanges so that exploitable dependence can be avoided. Thus the expectation is that universities and businesses would be willing to do joint research in as much as they are not in the same competitive environment, pursuing the same goals; particularly if they discover resources which they can exchange which are needed and scarce. Another important IOR concept is the interorganizational action set (Whetten, 1981) which is a coalition of organizations working together. Among other items, actions sets are dependent upon similarity of values and attitudes. The expectation here, then, is that universities and businesses might find coalitions difficult to form because of different values (profit vs. publication, etc.).

Rather than focusing on specific exchanges or coalitions, some IOR researchers examine entire organizational networks. Organizational networks consist of ties among all organizations in a population (Aldrich and Whetten, 1981). In this study, for example, the relevant network is the Florida State University System and high-technology manufacturing firms operating in the

State; they are joined, at least, by their common relationship to the state government. One type of network is the mandated network wherein organizations find that they must work together because of a law or set of regulations. One of the characteristics of such networks is the attempt by the organizations involved to place themselves in positions of influence (Raelin, 1980). If the Florida legislature, for example, were to require all firms of a given type to actively seek R&D assistance from the SUS as a condition to acquiring a tax benefit, they would be expected to jockey for access to the best SUS researchers and the most flexible university administrators. And universities would jockey for contracts with firms which have large R&D budgets.

Even such a large network as the SUS/high-technology firm system, does not exist in isolation. Mulford (1984) and Paulson (1984) argue that interorganizational relations (exchange, action sets, networks) must be analyzed from the perspective of the larger community. In the case of the present study, the focus is on the relevance of business-university relationships for the Florida economy and education and, in turn, for the general quality of life in the State.

In summary, then, the use of IOR theory as a conceptual framework for the research suggests several variables and levels for analysis of business-university joint research in Florida as shown in Illustration 1. Similar holistic models of university-business research relationships have appeared in the literature (Florida Bureau of Economic Analysis, 1982; U.S. Congress, 1980d:301; U.S. Congress, 1980c:259; U.S. Congress, 1979d:510). This general model was developed on the basis of IOR theory and the literature reviewed in this chapter. It formed the basic organizational and interpretative framework for the study. Although three IOR phases are shown (development, activity, outcomes) the major focus of the study is on the development phase. The arrows on the diagram indicate "influence" which may be positive or negative and weak or strong. This research represents first, and fairly qualitative, step in the analysis of this model. An ultimate goal, however, would be to develop precise enough estimates to allow for predictions of quantitative economic and educational outcomes of various government/business/university inputs and interaction forms. A variety of techniques for such analyses are available (cf. McLaughlin and Pickhardt, 1979).


IOR DEVELOPMENT
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IOR OUTCOMES
GOVERNMENT
Goals
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BUSINESS
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Resources
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Business Related Barriers
University Related Barriers
UNIVERSITIES
Goals
Resources
Structure
Process
Business and University Research Interaction
Economic Sector Development
Education Sector Development
Quality of Life in Florida
Other Systemic Inputs
Other Systemic Outcomes

A GENERAL MODEL FOR ANALYSIS OF UNIVERSITY-BUSINESS RESEARCH

CHAPTER III

METHODOLOGY

The methodology used to address the four objectives of the study (see Chapter I) involved three distinct information collection phases: (1) literature search, review and cataloging; (2) indepth personal interviews; (3) mailed questionnaires. These phases were cumulative in that the interviews were based on and expanded the knowledge base formed from the literature review. And the questionnaire phase was based on both the literature and interview results. The phases were reciprocal as well in that the interviews suggested additional literature. Much of the emphasis in the methodology, findings and conclusions sections of this report is on the questionnaire phase; this is because it is cumulative of the products of the other phases not because it is the more important information collection technique. This approach is very similar to the study of university-business relationships proposed by Azaroff (1972). The literature was reviewed in Chapter II. This chapter will focus on the interview and questionnaire data collection phases and the next chapter will present the questionnaire findings.

INTERVIEW DATA COLLECTION

In order to assess the accuracy of the knowledge base acquired from the literature, as well as to become more familiar with the Florida setting, in depth interviews were conducted with key personnel. In some cases the interviews were tape recorded and in others extensive notes were taken but in all cases the "Conversation Guidelines for University-Industry Research Project Contacts" was followed (see Appendix VIII). This insured that similar information was obtained while allowing an open-end interview format. This semi-structured approach to interviewing is typically referred to as "focused" interviewing (Bailey, 1978). The interviews were all conducted by the co-directors of the project, usually in the office of the interviewee. A brief description of the interviewees is provided below. The information which was obtained from these persons is not presented, in a systematic format, in this report. In most cases, the interviewees provided material for further reading which is reported and in many cases they provided detailed descriptions of incentives, methods and barriers which is included in the previous chapter and/or as items on the questionnaires.

1. Robert Cox, Deborah Gallay, John Pierce. Education Policy Unit, Office of the Governor of Florida.

2. Maury S. Hagerman. Economic Analysis Supervisor, Florida Bureau of Economic Analysis.

3. William Ingram. Director, North Central Florida State Technology Applications Center, University of North Florida.

4. Robert Ramey. Associate Dean, College of Engineering, University of Florida.

5. Gerald Jaski. Florida State University Attorney and Leader, Task Force on Law Affecting Entrepreneurship, Florida Department of Commerce.

6. Fred Williams. Director, Innovation Park, Tallahassee.

7. George R. Perkins, Associate Vice-Chancellor, Hank Hector, Coordinator of Planning and Analysis. Florida State University System Board of Regents.

8. William Grimm. Attorney and Leader, Task Force on Florida Law Affecting Venture Capital Formation, Florida Department of Commerce.

9. David Nylen. Dean, Stetson School of Business and Leader, Task Force on Management Education for Entrepreneurship, Florida Department of Commerce.

10. William Hamilton. Vice-President of Operations, Florida Computer Graphics, Inc.

11. Ralph Gunter. Executive Director. Ben Wishnut. Marketing Director, Central Florida Research Park.

12. William Waggener. Technical Director, Data Systems Division, Fairchild Weston Systems, Inc.

13. Alva Pennington. Treasurer, New College Foundation.

14. Carmen J. Palermo. Vice-President Chief Scientist, Government Sector, Harris Corporation.

QUESTIONNAIRE DATA COLLECTION

In order to assess the predispositions of universities and business firms to do joint research, two questionnaires were designed -- one for university administrators and one for business administrators. Much of the format and procedure for these questionnaires is similar and will be discussed in this introductory section. The unique aspects of format, procedures and response rate will be discussed in the next two sections. The findings from the analysis of the questionnaire responses is given in Chapter IV.

Fourteen useful examples of survey instruments used in research on business and/or university administrators were found and formed the basic models from which the questionnaires were designed (Berry et al., 1981; Cornia et al., 1978; Gerstenfeld, 1970; Jacobs, 1979; Mandell, 1975; McMillan, 1965; National Science Foundation, 1981a, 1981b, 1981c; Richardson et al., 1982; Sponsler, 1977a, 1977b; U.S. Congress 1982f; Arizona

Commission, 1981). In addition, the general reference by Dillman (1978) was also used as a guide as was the basic research methods text by Bailey (1978).

Appendix II contains illustrations of the instruments; they were folded together with an originally typed and signed cover letter and #9 business reply envelope (see Appendix I) and placed in an originally typed #10 envelope. Both questionnaires were printed (black) on 11x17 golden rod bond folded once to 8½x11. They were mailed on April 29, 1983, from the Pottsburg substation, Jacksonville Post Office with first class (machine) postage. A follow-up 4x6 first class (machine) postcard was sent to all sample members from the same Post Office on June 9, 1982 (see Appendix III). The closing date for receipt of completed questionnaires was set at June 29, 1983; eight have been received since this date but are not included in any of the analysis or discussion in this report. Details on return rates are discussed below for each of the samples; overall, 252 (47%) of the adjusted total mailout of 539 were returned.

Because the focus of the study is on predispositions to interact, samples of administrators -- university and business -- were chosen to receive and fill out the questionnaire. Most of the questions were phrased in terms of the possible activities of the administrators' units. In both cases, it was believed that administrators would be in a better position to accurately assess their unit's future activity than nonadministrators. This is because they are more likely to control goals, resources, structures and process (see Chapter II0)and they are more likely to have had substantial experience in the organization itself.

University Sample and Instrument

All nine State University System schools (including the branches of USF-St. Petersburg, USF-Sarasota and FIU-North Miami) were included in the study and the following administrative titles were selected for every school where such a title (or similar wording) existed.

President

Vice-President (academic affairs, agricultural affairs, research)

Director (sponsored research, business research, health research, technologies, biological sciences, oceanography institute, R&D shop)

Dean (engineering, research, graduate studies, agriculture, pharmacy, medicine, arts and science, business)

Chairperson (selected units within areas of directors and deans listed above including various engineering, physical science, social science, agriculture, mathematics, management, marketing, pharmacy, medicine, accounting, information systems and finance departments)

Using current university catalogs, the State of Florida Telephone Directory, documents such as the Annual Research Report for the Engineering and Industrial Experiment Station and information from university telephone operators, a list of 255 such administrators was constructed. This list is believed to be (1) inclusive of all persons with titles such as these listed above and (2) heavily weighted with administrators of "high-technology" educational units in the State University System (SUS) of Florida. Technically, the list must be considered a judgmental (Bailey, 1978) sample of SUS administrators although it is assumed to be very close to an entire enumeration of high-technology units. As discussed in Chapter I, the vagueness of "high-technology" as a concept makes exact operationalization difficult.

Although 255 questionnaires were actually mailed, the reported mailout is 249 -- an adjusted figure which excludes six administrators who did not fill out the questionnaire because, as they indicated, they shared administrative duties with others who did fill out the questionnaire and returned it. The response rate by school is as follows:

SCHOOL	ADJUSTED MAILOUT	USEFUL RECEIPTS	PERCENTAGE RESPONSE
UNF	14	9	64%
UCF	22	16	73%
FSU	30	15	50%
UF	62	42	68%
USF	37	20	54%
UWF	16	6	38%
FAU	23	13	57%
FIU	26	12	46%
FAMU	19	3	16%
OVERALL	249	136	55%

The content of the questionnaire follows the general purposes of the project (Chapter I) and specific suggestions in the literature (Chapter II) and from the interviews (see above section on "Interview Data Collection"). Most of the space in the questionnaire is devoted to four sets of statements which respondents were asked to evaluate. The four sets are as follows:

(1) Incentives to the University for engaging in research with business firms (7 items).

(2) Incentives to business firms for engaging in research with universities (9 items).

(3) Barriers to conducting joint research (10 items).

(4) State activities to encourage joint research (9 items).

Each set of items (see Appendix II) was followed by (1) an "other" item where respondents could indicate items which they felt were important but did not appear on the questionnaire and (2) a box where the respondents could indicate one item of the set which, more clearly than the others, was important. Two open-end questions on actual joint research activity and one for "other comments" were also on the questionnaire. These responses are not exhaustively analyzed in this report, in as much as they were not responded to by most of the respondents. The responses are, however, used as illustrations of representative comments and anecdotal material for the analysis of the closed-end statements.

Eight characteristics of the respondents (university, position, time in position, unit affiliation, affiliation time, highest educational degree and field, length of residence in Florida) and one (R&D funds from industry for 1982-1983) characteristic of the unit were also documented. The purpose of documenting these characteristics was to provide a basis for elaborating (Bailey, 1980) the analysis of the frequency distributions of responses to items in the four main sets described above. When the data were initially inspected, three of these characteristics seemed, heuristically, to provide additional information about sub-samples of respondents and, hence, additional analysis of responses by these categories was made (see Parts II, III and IV of Tables 1 to 4). These elaborating or "control" variables which isolate various sub-samples are as follows:

(A) School -- three sub-samples are identified which range, roughly, from hi-tech research emphasis to non-hi-tech research emphasis and these are:

(1) UF/FSU (n=57)
(2) CF/SF (n=36)
(3) others (n=43)

(B) Dollars -- three sub-samples are identified which range from none to high amounts of industrial R&D funding and these are:

(1) None	(n=71)
(2) Under $100,000	(n=38)
(3) Over $100,000	(n=27)

(C) Field -- in terms of the field of the respondents' highest educational degree, two sub-samples are identified which range from engineering, math, physical science and medicine to business, social and behavioral sciences and are referred to as:

(1) high-technology	(n=71)
(2) business/social science	(n=55)

For the last control variable of field, ten respondents were eliminated because they did not indicate a field.

Business Sample and Instrument

As discussed above, the general criterion for selection of organizations to receive the questionnaire was a clear emphasis in the area of high-technology research in the State of Florida. In terms of business firms, the sample was restricted to manufacturing companies in that they would be more likely to be concerned about, and have, research and development activities. Further, the sample was restricted to only those manufacturing firms with a manufacturing site in Florida -- not necessarily a home office or sales office facility, but a locally managed manufacturing facility. A relatively exhaustive and accurate listing of Florida manufacturing sites or "establishments" is provided by the Directory of Florida Industries 1982 which contains information about (approximately) 7000 establishments. The listing includes all Florida manufacturers known to the Florida Chamber of Commerce (regardless of membership in the Chamber) who completed their questionnaire in August, 1981. Entries in the directory provide information about products and their Standard Industrial Classification (SIC) codes. To identify "high-technology" establishments, the Florida Department of Commerce listing of "high-technology" SIC codes was used. As of April, 1983, these codes were as follows:

SIC CODE	TYPE OF PRODUCT MANUFACTURED
283	Drugs (biological, medicinal, botanical, pharmaceutical)
3573	Electronic computing equipment
366	Communication equipment
367	Electronic components and accessories
372	Aircraft parts
376	Guided missles and space vehicles and parts
381	Engineering, laboratory, scientific and research instruments
382	Measuring and controlling instruments
383	Optical instruments and lenses
384	Surgical, medical and dental instruments
385	Opthalmic goods

A total of 845 establishments were listed among these categories. A large number of these establishments were listed more than once because they had product lines in two or more categories; in addition, many of the listed firms had "packaging" or similar activity as their sole manufacturing process indicating that they were not involved in product development per se and would probably not have a need for high-technology research. When these establishments were eliminated, the list contained 304 firms. The final "sample," then, is a judgmental one although it is assumed to be very representative and include a large portion of Florida business firms concerned with high-technology manufacturing or product development research.

Questionnaires were addressed to the top executive who had primary responsibility for the establishment. Although 304 questionnaires were actually mailed, the reported mailout is 290 -- an adjusted figure which excludes fourteen questionnaires which were returned because the establishment had changed addresses with no forwarding address available. The response rate was 40% -- 116 questionnaires were returned in usable form. In addition to the control variables discussed below, the respondents provided information which characterizes them as follows:

(1) Average length of time on the job: 7 years, 1½ months.

(2) Average length of time employed in Florida: 13 years, 1 month.

(3) Average age: 49 years, 1 month.

(4) Percentage holding educational degrees beyond the bachelors level: 49%.

(5) Average number of employees in the respondent's establishment: 841 (median: 200).

(6) Average number of employees involved in research and development: 95 (median: 10).

Using an approach very similar to that described above for the university administrator questionnaire, most of the space on the business administrator questionnaire was devoted to three sets of statements which the respondents were asked to evaluate. These sets of statements are as follows:

(1) Incentives to businesses for engaging in research with universities (14 items).

(2) Barriers to conducting joint research (11 items).

(3) Business activities to strengthen business-university relations (12 items).

Similar to the university questionnaire, the business questionnaire included "other" categories and a place to indicate which statement, if any, in a set was clearly more important than the rest. Control variables, likewise, were identified which allowed for the specification of responses by various categories or sub-samples. These variables are as follows:

(A) Ratio -- three sub-samples are identified by categorizing the ratios formed by dividing the number of R&D employees by the total number of employees.

    (1) none (n=23)
    (2) 1% to 9% (n=40)
    (3) 10% to 19% (n=20)
    (4) 20% to 65% (n=33)

(B) Title -- because the questionnaires were often filled out by someone other than the original (chief executive) addressee, two categories were formed for sub-sample analysis.

(1) Chief executive (n=47)
(2) Other officer (n=69)

(C) Field -- For those executives who held college degrees, two categories of major field of study were created.

(1) Science or engineering (n=40)
(2) Other (n=36)

Information on college major was not available for 40 respondents including 12 who did not have a college degree.

(D) Size -- Two variables were combined to produce this control variable (site description - single, branch or headquarters, and 1982 sales volume) which has three categories.

(1) single site and under $1 million (n=11)
(2) single site and between $1 million $10 million (n=18)
(3) all others (n=69)

The number of non-responses for this last control variable of size was 18. The purpose of isolating so few firms (11 and 18, or 29 total) was to focus on the smaller organizations -- those assumed to be most similar to the entrepreneurial type of high-technology firm which might be expected to become more dominant in Florida's economy in future years. This does, however, point to a major limitation of the study which is the inability to directly assess the attractiveness of Florida's higher educational system in general, and joint R&D projects in specific, to the emerging entrepreneurial firm -- those giving consideration to Florida as a possible location. Such firms are difficult to locate and a listing of them was not found, hence this focus on the single site/small sales firm as a surrogate. It is assumed that a few of these 29 firms are of this emerging type but no direct evidence of this is available.

CHAPTER IV

QUESTIONNAIRE FINDINGS

UNIVERSITY ADMINISTRATOR QUESTIONNAIRE

In this section of the report the responses to the opinion portion of the questionnaire which was administered to the sample of university administrators (see Chapter III for details of the sample) will be presented and discussed. Four different sets of opinion statements appear on the questionnaire and they are analyzed separately and presented as Tables "1," "2," "3" and "4." The overall frequencies of responses are presented in Part I of each table and the average responses for various categories of three control variables are presented as Parts II, III and IV. These control variables are the "school," "dollar," and "field" variables discussed in Chapter III.

Findings are based on an analysis approach which is repeated for each table. This approach focuses on certain "pointers" which indicate the possibility of an important distinction in the data. For the general frequencies (Part I) the pointers are: (1) rank order of average response to the items; (2) the absolute value of the averages; (3) the response to the question which followed each set of items and was worded "if one of these statements is clearly more important than the others, write the number of the response in the provided box." For the tables which present detailed statistics for categories of the control variables (Parts II, III and IV) the pointers are (1) rank order of the hi-tech/UF-FSU/over $100K industrial research category and deviation of this ordering from the overall ranking; (2) Pearson product moment zero-order correlation of the control variable categories by response categories; (3) chi-square value for the control categories by response categories table. The use of the pointers is judgmental -- only the most certain, or extreme, of the findings will be discussed in this report.

State Activities to Facilitate Industry-University Research

Table 1, Part I, presents the responses about nine statements of alternative actions the State might take, or support, which could facilitate the development of research relationships between business firms and the state universities of Florida. Three of these items (9-"parks," 5-"exchanges," 8-"funds") are clearly more highly favored than the rest. They are ranked 1st, 2nd and 3rd and are the only items with average responses above 2.5 indicating a bias toward the "very useful" (3.0) response versus "somewhat useful" (2.0) or "not useful" (1.0). In addition, these items have the highest percentage of "clearly most important" selection (34%, 19%, 27%). At the other end of the continuum are three items which are clearly less favored than the others (4-"university coordination," 6-"SBD centers," 3-"state coordination"). These items were ranked 7th, 8th and 9th, they are the only items with average responses below 2.0 (i.e. between "not" and "somewhat" useful) and only one item (4) was selected as "clearly most important" and then only by one respondent (1.5%). In summary, then, it is clear that from the point of view of the SUS administrator, the State can be helpful in facilitating joint business-university research but only in the linking or providing of resources: physical (parks), personnel (exchanges) and monetary (funds). Just as clear is the finding that external control (by the university, small business development centers or State coordinating bodies) is not seen as a useful mechanism. The "intermediate" response remaining items (1-listing, 2-conferences, 7-on site education) are interpreted as being in an uncertain position -- neither clearly desirable, not clearly undesirable.

Illustration 1. Summary of findings of university administrators' perception of the desirability of alternative state activities to facilitate business-university research.

Most Desirable	Least Desirable
Provide Resources	Provide Controls
-Parks	-University
-Personnel	-State
-Funds	-SBDC

Table 1, Parts II, III and IV, essentially replicate Part I of the table and, hence, the findings. Two major exceptions can be noted. (1) Part II indicates that research parks are most favored by UCF and USF, more so than by UF and FSU, and much more so than by the five other schools in the System. The chi-square value indicates a significant difference among the school-by-response category cells. The UCF/USF mean of 2.73 is the highest average response given to any of the items of the set either overall or by any of the various control variable categories of respondents. (2) Item 1-"State maintained listings" is an intermediate item, but far more favored by units without any industrial research funding than by other units. The average response of 2.40 (no funding) is indicated by the correlation and chi-square values to be substantially different than 2.22 (under $100K) and 2.08 (over $100K). These exceptions offer some clarification although the overall conclusions as shown in Illustration 1 are not affected.

Incentives for Engaging in Joint University-Business Research

Table 2, Part I, presents a summary of the responses to seven statements of alternative incentives to university units for engaging in joint research with business organizations. Across a 5-point response scale (5-very desirable to 1-very undesirable) the average item response ranged from 3.67 (#1) to 4.14 (#2, #5) -- a relatively tight range. The modal response for all seven items was 4.00 ("desirable"). In terms of item ranks by average response, there are two ties (#2 with #5 and #6 with #7); together these four items occupy the highest four rank positions. The question concerning "the clearly most important" item of the set produced a percentage range of 7.9% (#3) to 17.5% (#2) -- again, a relatively tight range. All of these pointers suggest that: (1) all incentives would be desirable; (2) there are not major differences among them in terms of relative desirability.

When the overall frequencies are crossclassified by the three control variables (Table 2, Parts II, III and IV) the resulting rank orders within hi-tech/UF-FSU/over $100K categories are very similar to the overall rankings (i.e., Table 2, Part I); no item shifts more than two ranks. Hence, in general, the overall rank orders are replicated. Within rank positions, however, there are patterns of differential responses by control variables, or sub-sample, categories. These differentials are pointed to by correlation coefficients and chi-square values; in all cases at least two such pointers for at least two of the control variables which provide consistent interpretations is the minimum level of evidence required for such a pattern to be considered. Illustration 2 summarizes these patterns.

Illustration 2. Summary of differential emphasis among university units given to rule and reward changes as incentives for university involvement in joint research projects with business organizations.

Hi-Tech UF/FSU, or Over $100K Industry Funding units	Non-hi-tech, Non-UF/FSU, or Under $100K Industry funded units
Change Rules Structure	Change Reward Structure
-Patent Policy -Procurement Regulations -Policy for Interaction with Business	-Tenure and Promotion -Salary Overload Allowances

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Again, it must be emphasized that these are not major discriminators. The rank orders of the items by the entire sample and by various sub-samples are very similar. Within ranks, between sub-samples, however, there are modest but real differences and these are recorded in Illustration 2. Apparently, in the technical-industrial-research oriented university unit, the reward structure already produces incentives (tenure, promotion, salary overloads) for joint work where as in other units, these are conditions that have yet to be achieved while the more technical procedures such as retaining patent rights and speedy purchasing are seen by the technical-industrial-research unit as being more important.

University Perceptions of Responsiveness of Industry to Incentives for Joint University-Industry Research.

The nine statements of this set (Table 3) focus on incentives to businesses to become involved in joint research with universities. The university administrators were asked to assess how responsive Florida businesses would be to each. The overall findings are quite straight forward. The top six ranked (Table 3, Part I, items 1 through 5 and 8) items have average responses which differ at the most by 0.20 and the remaining (lowest) three ranks (items 6, 7, 9) differ at most by 0.06, yet the minimum difference between these two sets of items is 0.60. Further, the three lowest ranked items all have average responses below 2.00 (highest = 1.73) while the other six are all above 2.00 (lowest = 2.33). In response to the question concerning "the clearly most important" items of the set, the three lowest ranked items are selected by only one respondent; those most often selected were #1 (28%), #5 (25%), #8 (19%) and #3 (9%). Taken as two distinct clusters of items, then, the respondents felt very positive about one set (#1 through #5 and #8) and very negative about the other set (#6, #7 and #9). When the contents of the items of these sets are examined the smaller cluster seems much more homogeneous (university accountability and entrepreneur education). It may have been that the respondents felt, in general, that, with a few exceptions, any incentive would produce a response and, thus, answered the items favorably if they were not among the few excepted areas. Among the "favorable" six items, there are almost as many themes as items, although because items #1, #3, #5 and #8 stand out, an accurate summary of favorable incentives might be: "patents, funds, and quality faculty." Illustration 3 summarizes these findings.

Illustration 3. University Administrators' Perceptions of the Responsiveness of Industry to Incentives for Joint Research.

Incentives Believed to Encourage Business	Incentives Not Believed to Encourage Business
-Patent rights	-University Accountability
-Funds	-Entrepreneurship Programs
-Quality Faculty	

The analysis by various control variables essentially replicates the overall analysis. No more than two rank positions are shifted for any item in comparing overall ranks to ranks by hi-tech units, units with over $100K industry funding, or UF/FSU units. The key items (from the above discussion) are #6, #7 and #9 and they are always located in the last three rank positions and they have average responses of less than 2.00 (where 2.00 indicates "somewhat responsive"). None of the other items ever go below this value.

The correlation and chi-square values to point to a few exceptions and extremes. Entrepreneurial education (#7) seems to be slightly more important as a perceived business incentive by university administrators in business-social science fields and in schools other than UF/FSU. The two highest average responses of any control variable category or sub-sample were in the "under $100K" industrial funding group and these are #2- "State assistance to new firms" (2.68), and #5- "increased faculty quality" (2.64) items. These additional findings clarify, but do not alter, the basic findings as reported in Illustration 3.

Perceived Barriers to Joint Research with Business Firms

Table 4 (Part I) lists ten situations or conditions which initial interviews and the literature suggested might be seen by university administrators as barriers to joint research. Of these ten items, one stands out as being far more serious as a barrier than any of the others: "available resources and student loads" (#9). Fifty percent reported this item to be a "major" barrier as compared to 21% for the next highest ranked item (#10-"effectiveness of business-industry communication"). Thirty-seven percent of those who chose an item as "clearly more important" chose this one, as compared to 13% for #10, the second ranked item. The third ranked item (#2-"time constraints of industrial research") was mentioned by 7.4% and had an average response of 1.92 (possible range 1.0 to 3.0) and the remaining seven items had averages responses of under 1.80 indicating that they are not perceived as being important barriers. This general lack of perceived importance suggest that several "barriers" are more likely to be misleading stereotypes than real perceptions, and that, for the most part, university administrators do not perceive a large multicomponent barrier to interaction. One such stereotype area is identified by items #5 ("anti-academic attitudes of businessmen") and #6 ("business infringement on academic freedom"). In both cases, about 1/2 of the respondents throught that these are "minor" barriers and for about 1/3, they were not thought to be a barrier at all. Clearly, for these respondents, ideological differences as to the purpose of the university is not seen as a problem in interacting with businessmen on a research basis. Rather, the major barrier is seen to be a lot closer to home -- available resources and student loads.

Item #3 ("opportunity for involvement in real world problems") received a 92% response of "not a barrier." This response probably reflects the very idealistic wording of the statement, and, hence, invalidates any specific conclusions drawn from it.

When the overall frequencies are cross-classified by various control categories or sub-samples, the general conclusions, discussed above, remain in tact. In two instances, the control variables more clearly specify the conclusions: (1) #9 "resources and student loads" is especially perceived as a barrier in non-UF/FSU units and in those which have industrial funding under $100K; (2) #10-"effectiveness of business-university communication" is especially perceived as a barrier in units which have no industrial research funding. The controlled analysis also isolated two exceptions to the overall conclusions: (1) #8-"competition from universities outside Florida" moves from 4th rank overall to 8th rank for UF/FSU, thus while it is unimportant in general, it is very unimportant for UF/FSU; (2) #6-"business infringement on academic freedom" appears to be more important issue for the "hi-tech" units than others -- average response of 1.90 (3rd rank) versus 1.77 overall (5th rank) and 1.59 for business-social science units.

As a general conclusion, then, university administrators do not perceive very many types of barriers in doing joint research work with business organizations. The major barrier, which is widely perceived, however, is available resources and student loads and this is particularly perceived as a barrier at the regional universities and in units which have modest amounts of industrial fundings for research.

TABLE 1

RESPONSES TO UNIVERSITY QUESTIONNAIRE ITEMS CONCERNING TYPE OF STATE ACTION TO FACILITATE INDUSTRY-UNIVERSITY RESEARCH
PART I: OVERALL STATISTICS

TYPE OF STATE ACTION TO FACILITATE INDUSTRY-UNIVERSITY RESEARCH	RESPONSE PERCENTAGES* NOT USEFUL (1)	SOMEWHAT USEFUL (2)	VERY USEFUL (3)	OVERALL AVERAGE RESPONSE	RANK BY OVERALL AVERAGE	NUMBER WHO SELECTED AS MOST IMPORT.
1. State maintained listing of university research expertise and experience. (132)	11	51	39	2.28	5	5
2. State supported business-university research conferences. (132)	9	42	49	2.39	4	4
3. State level advisory/coordinating body for business-university research. (132)	36	47	17	1.82	9	0
4. Establish university mechanisms for coordinating and controlling industrial research activity. (128)	31	48	21	1.91	7	1
5. Faculty-company research staff exchanges. (130)	6	32	62	2.56	2	13
6. Include R&D advising in role of small business development centers. (125)	27	58	15	1.88	8	0
7. On site technical education of industry personnel. (127)	13	53	35	2.22	6	1
8. State funding earmarked for supporting university-industry research activity. (128)	11	26	63	2.52	3	18
9. Establish university affiliated research parks with research facilities available for emerging firms. (130)	8	27	65	2.58	1	23

*Actual number of respondents are shown in parentheses. Percentages sum to 100% (± 1% for rounding) for each row.

RESPONSES TO UNIVERSITY QUESTIONNAIRE ITEMS CONCERNING TYPE OF STATE ACTION TO FACILITATE INDUSTRY-UNIVERSITY RESEARCH
PART II: DETAILED STATISTICS BY TYPE OF UNIVERSITY

TABLE 1

	AVERAGE RESPONSES**					
TYPE OF STATE ACTION TO FACILITATE INDUSTRY-UNIVERSITY RESEARCH	UF/FSU	CF/SF	OTHERS	RANK BY UF/FSU	CORRELATION	CHI-SQUARE
1. State maintained listing of university research expertise and experience.	2.17	2.55	2.21	6	+.04	9.05
2. State supported business-university research conferences.	2.32	2.61	2.34	4	+.02	5.79
3. State level advisory/coordinating body for business-university research.	1.74	1.97	1.79	9	+.04	2.43
4. Establish university mechanisms for coordinating and controlling industrial research activity.	1.83	1.88	2.03	7	+.11	5.16
5. Faculty-company research staff exchanges.	2.53	2.63	2.55	2	+.02	3.93
6. Include R&D advising in role of small business development centers.	1.79	2.03	1.85	8	+.04	2.96
7. On site technical education of industry personnel.	2.31	2.27	2.07	5	-.15*	3.96
8. State funding earmarked for supporting university-industry research activity.	2.49	2.64	2.46	3	-.01	1.84
9. Establish university affiliated research parks with research facilities available for emerging firms.	2.60	2.73	2.41	1	-.12	10.94*
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(49-54)	(34-35)	(40-43)			

*significant at $a < .05$

** Range is from 1 (not useful) to 3 (very useful)

TABLE 1

RESPONSES TO UNIVERSITY QUESTIONNAIRE ITEMS CONCERNING TYPE OF STATE ACTION TO FACILITATE INDUSTRY-UNIVERSITY RESEARCH PART III: DETAILED STATISTICS BY LEVEL OF R&D FUNDING BY INDUSTRY

TYPE OF STATE ACTION TO FACILITATE INDUSTRY-UNIVERSITY RESEARCH	AVERAGE RESPONSES**					
	NONE	UNDER $100K	OVER $100K	RANK BY OVER $100K	CORRELATION	CHI-SQUARE
1. State maintained listing of university research expertise and experience.	2.40	2.22	2.08	6	-.21*	11.53*
2. State supported business-university research conferences.	2.36	2.36	2.52	4	+.09	5.10
3. State level advisory/coordinating body for business-university research.	1.89	1.69	1.82	9	-.07	4.40
4. Establish university mechanisms for coordinating and controlling industrial research activity.	1.93	1.90	1.88	7.5	-.02	2.01
5. Faculty-company research staff exchanges.	2.46	2.66	2.62	2	+.10	4.62
6. Include R&D advising in role of small business development centers.	1.94	1.78	1.88	7.5	-.06	2.02
7. On site technical education of industry personnel.	2.11	2.25	2.42	5	+.19*	10.67*
8. State funding earmarked for supporting university-industry research activity.	2.41	2.68	2.60	3	+.14	5.81
9. Establish university affiliated research parks with research facilities available for emerging firms.	2.46	2.74	2.65	1	+.16*	6.28
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(63-66)	(37-38)	(25-27)			

*significant at a <.05

**Range is from 1 (not useful) to 3 (very useful)

TABLE 1

RESPONSES TO UNIVERSITY QUESTIONNAIRE ITEMS CONCERNING
TYPE OF STATE ACTION TO FACILITATE INDUSTRY-UNIVERSITY RESEARCH
PART IV: DETAILED STATISTICS BY SPECIALTY FIELD OF RESPONDENT

TYPE OF STATE ACTION TO FACILITATE INDUSTRY-UNIVERSITY RESEARCH	AVERAGE RESPONSES**				
	HI-TECH***	BUSI-SOC	RANK BY HI-TECH	CORRELATION	CHI-SQUARE
1. State maintained listing of university research expertise and experience.	2.31	2.23	5	-.07	3.00
2. State supported business-university research conferences.	2.44	2.33	4	-.09	1.01
3. State level advisory/coordinating body for business-university research.	1.82	1.82	8.5	-.01	1.30
4. Establish university mechanism for coordinating and controlling industrial research activity.	1.93	1.88	7	-.04	0.29
5. Faculty-company research staff exchanges.	2.52	2.61	3	-.07	2.51
6. Include R&D advising in role of small business development centers.	1.82	1.90	8.5	+.05	0.62
7. On site technical education of industry personnel.	2.25	2.16	6	-.07	3.07
8. State funding earmarked for supporting university-industry research activity.	2.59	2.47	2	-.09	1.04
9. Establish university affiliated research parks with research facilities available for emerging firms.	2.71	2.41	1	-.24*	8.84*
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(67-70)	(48-52)			

*significant at a $< .05$
**range is from 1 (not useful) to 3 (very useful)
***includes Engineering, Science, Math and Medicine

RESPONSES TO UNIVERSITY QUESTIONNAIRE ITEMS CONCERNING INCENTIVES FOR ENGAGING IN JOINT UNIVERSITY-BUSINESS RESEARCH

TABLE 2

PART I: OVERALL STATISTICS

INCENTIVES TO UNIVERSITIES FOR ENGAGING IN JOINT RESEARCH	RESPONSE PERCENTAGES*					OVERALL AVERAGE RESPONSE	RANK BY OVERALL AVERAGE	NUMBER WHO SELECTED AS MOST IMPORT.
	Very Undesirable (1)	Undesirable (2)	Not Relevant (3)	Desirable (4)	Very Desirable (5)			
1. More credit given toward tenure and promotion for R&D work with private sector. (129)	2	9	27	44	18	3.67	7	12
2. State maintained listings of industrial research needs. (132)	1	1	16	49	34	4.14	1.5	14
3. University retaining some interest in patents from work done by university researchers for industry (127)	1	10	20	45	24	3.82	5	6
4. Release time for establishing industrial contacts. (132)	3	10	21	40	26	3.76	6	13
5. Establish clear State University System policy on industry-university research activity. (132)	2	3	9	50	36	4.14	1.5	10
6. Expand salary overload allowances. (129)	5	9	10	38	38	3.96	3.5	12
7. Relax state procurement regulations. (122)	2	5	24	35	34	3.96	3.5	10

*Actual number of respondents are shown in parentheses. Percentages sum to 100% (+ 1% for rounding) for each row.

TABLE 2

RESPONSES TO UNIVERSITY QUESTIONNAIRE ITEMS CONCERNING INCENTIVES FOR ENGAGING IN JOINT UNIVERSITY-BUSINESS RESEARCH

PART II: DETAILED STATISTICS BY TYPE OF UNIVERSITY

INCENTIVES TO UNIVERSITIES FOR ENGAGING IN JOINT RESEARCH	AVERAGE RESPONSES**					
	UF/FSU	CF/SF	OTHERS	RANK BY UF/FSU	CORRELATION	CHI-SQUARE
1. More credit given toward tenure and promotion for R&D work with private sector.	3.50	3.53	4.00	7	+.22*	11.54
2. State maintained listings of industrial research needs.	4.00	4.34	4.16	3	+.10	8.18
3. University retaining some interest in patents from work done by university researchers for industry.	3.98	3.78	3.63	4	-.16*	6.39
4. Release time for establishing industrial contacts.	3.70	3.91	3.71	6	+.01	8.16
5. Establish clear State University System policy on industry-university research activity.	4.17	4.31	3.95	1	-.10	10.15
6. Expand salary overload allowances.	3.96	3.94	3.94	5	-.01	6.29
7. Relax state procurement regulations.	4.12	3.97	3.74	2	-.17*	11.03
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(50-54)	(33-35)	(37-43)			

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*Significant at a < .05

**Range is from 1 (Very Undesirable) to 5 (Very Desirable)

RESPONSES TO UNIVERSITY QUESTIONNAIRE ITEMS CONCERNING INCENTIVES FOR ENGAGING IN JOINT UNIVERSITY-BUSINESS RESEARCH

TABLE 2

PART III: DETAILED STATISTICS BY LEVEL OF R&D FUNDING BY INDUSTRY

INCENTIVES TO UNIVERSITIES FOR ENGAGING IN JOINT RESEARCH	AVERAGE RESPONSES**			RANK BY OVER $100k	CORRELATION	CHI-SQUARE
	None	Under $100K	Over $100K			
1. More credit given toward tenure and promotion for R&D work with private sector.	3.69	3.68	3.56	7	-.06	3.59
2. State maintained listings of industrial research needs.	4.21	4.00	4.19	2.5	-.04	5.45
3. University retaining some interest in patents from work done by university researchers or industry.	3.71	3.75	4.19	2.5	+.18*	14.35
4. Release time for establishing industrial contacts.	3.75	3.79	3.74	5.5	+.01	7.29
5. Establish clear State University System policy on industry-university research activity.	4.00	4.18	4.41	1	+.18*	21.67*
6. Expand salary overload allowances.	3.92	4.19	3.70	5.5	-.04	16.13*
7. Relax state procurement regulations	3.76	4.16	4.12	4	+.17*	11.28
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(59-67)	(36-38)	(26-27)			

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*Significant at a < .05

**Range is from 1 (Very Undesirable) to 5 (Very Desirable)

TABLE 2

RESPONSES TO UNIVERSITY QUESTIONNAIRE ITEMS CONCERNING INCENTIVES FOR ENGAGING IN JOINT UNIVERSITY-BUSINESS RESEARCH
PART IV: DETAILED STATISTICS BY SPECIALTY FIELD OF RESPONDENT

INCENTIVES TO UNIVERSITIES FOR ENGAGING IN JOINT RESEARCH	AVERAGE RESPONSES				
	Hi-Tech***	Busi-Soc	RANK BY HI-TECH	CORRELATION	CHI-SQUARE
1. More credit given toward tenure and promotion for R&D work with private sector.	3.46	3.92	7	+.24*	8.92
2. State maintained listings of industrial research needs.	4.19	4.13	2	-.01	1.40
3. University retaining some interest in patents from work done by university researchers for industry.	4.00	3.55	4	-.24*	8.51
4. Release time for establishing industrial contacts.	3.70	3.77	6	+.03	0.64
5. Establish clear State University System policy on industry-university research activity.	4.27	3.94	1	-.18*	7.72
6. Expand salary overload allowances.	3.73	4.17	5	+.19*	7.78
7. Relax state procurement regulations.	4.10	3.78	3	-.17*	7.79
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(68-70)	(46-52)			

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*Significant at a < .05

**Range is from 1 (Very Undesirable) to 5 (Very Desirable)

***Includes Engineering, Science, Math and Medicine

RESPONSES TO UNIVERSITY QUESTIONNAIRE ITEMS CONCERNING INCENTIVES TO INDUSTRY FOR ENGAGING IN JOINT UNIVERSITY-BUSINESS RESEARCH

TABLE 3

PART I: OVERALL STATISTICS

INCENTIVE TO INDUSTRY FOR ENGAGING IN RESEARCH WITH UNIVERSITY UNITS	RESPONSE PERCENTAGES* Not Responsive (1)	Somewhat Responsive (2)	Very Responsive (3)	OVERALL AVERAGE RESPONSE	RANK BY OVERALL AVERAGE	NUMBER WHO SELECTED AS MOST IMPORT.
1. State corporate income tax credit on R&D expenditures with state universities. (124)	4	44	52	2.48	2	15
2. State assistance in financing new firms doing part of their R&D with universities. (125)	9	40	51	2.42	4	3
3. Corporation retaining patent rights to innovations developed by university researchers under contract with the company. (124)	5	37	58	2.53	1	5
4. Low interest loans from State to firms to purchase research from State University System. (126)	9	50	41	2.33	6	1
5. Increased quality of university faculty. (126)	11	34	55	2.44	3	13
6. Increased accountability and control of university research projects. (124)	44	46	11	1.67	9	1
7. State supported sources of managerial assistance for entrepreneurs. (122)	42	47	12	1.70	8	1
8. State pays a portion of a company's expenditures on university research. (126)	13	38	49	2.37	5	10
9. Develop educational programs in entrepreneurship. (122)	42	43	15	1.73	7	1

*Actual number of respondents are shown in parentheses. Percentages sum to 100% (± 1% for rounding) for each row.

RESPONSES TO UNIVERSITY QUESTIONNAIRE ITEMS CONCERNING INCENTIVES TO INDUSTRY FOR ENGAGING IN JOINT UNIVERSITY-BUSINESS RESEARCH

PART II: DETAILED STATISTICS BY TYPE OF UNIVERSITY

TABLE 3

INCENTIVE TO INDUSTRY FOR ENGAGING IN RESEARCH WITH UNIVERSITY UNITS	AVERAGE RESPONSES** UF/FSU	CF/SF	Others	RANK BY UF/FSU	CORRELATION	CHI-SQUARE
1. State corporate income tax credit on R&D expenditures with state universities.	2.52	2.54	2.40	1.5	-.09	5.37
2. State assistance in financing new firms doing part of their R&D with universities.	2.45	2.48	2.35	3	-.07	1.65
3. Corporation retaining patent rights to innovations developed by university researchers under contract with the company.	2.52	2.62	2.48	1.5	-.03	9.09
4. Low interest loans from State to firms to purchase research from State University System.	2.37	2.36	2.26	6	-.07	2.82
5. Increased quality of university faculty.	2.38	2.47	2.49	4.5	+.07	1.95
6. Increased accountability and control of university research projects.	1.56	1.92	1.63	9	+.06	8.43
7. State supported sources of managerial assistance for entrepreneurs.	1.58	1.76	1.81	8	+.16*	7.12
8. State pays a portion of a company's expenditures on university research.	2.38	2.42	2.30	4.5	-.04	0.84
9. Develop educational programs in entrepreneurship.	1.67	1.83	1.72	7	+.04	2.25
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(50-53)	(29-31)	(41-43)			

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*significant at a < .05

**range is from 1 (not responsive) to 3 (very responsive)

RESPONSES TO UNIVERSITY QUESTIONNAIRE ITEMS CONCERNING INCENTIVES TO INDUSTRY FOR ENGAGING IN JOING UNIVERSITY-BUSINESS RESEARCH

TABLE 3

PART III: DETAILED STATISTICS BY LEVEL OF R&D FUNDING BY INDUSTRY

INCENTIVE TO INDUSTRY FOR ENGAGING IN RESEARCH WITH UNIVERSITY UNITS	AVERAGE RESPONSES**			RANK BY OVER $100K	CORRELATION	CHI-SQUARE
	None	Under $100K	Over $100K			
1. State corporate income tax credit on R&D expenditures with state universities.	2.44	2.48	2.61	2	+.10	2.37
2. State assistance in financing new firms doing part of their R&D with universities.	2.28	2.68	2.43	4	+.15	9.49*
3. Corporation retaining patent rights to innovations developed by university researchers under contract with the company.	2.53	2.43	2.68	1	+.07	3.17
4. Low interest loans from State to firms to purchase research from State University System.	2.32	2.36	2.28	6	-.01	2.74
5. Increased quality of university faculty.	2.31	2.64	2.50	3	+.16*	11.90*
6. Increased accountability and control of university research projects.	1.60	1.80	1.68	9	+.08	8.79
7. State supported sources of managerial assistance for entrepreneurs.	1.71	1.60	1.79	7	+.02	7.52
8. State pays a portion of a company's expenditures on university research.	2.36	2.36	2.38	5	+.01	0.33
9. Develop educational programs in entrepreneurship.	1.73	1.74	1.70	8	-.01	0.45
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(63-66)	(34-36)	(24-26)			

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*significant at a < .05

**range is from 1 (not responsive) to 3 (very responsive)

RESPONSES TO UNIVERSITY QUESTIONNAIRE ITEMS CONCERNING INCENTIVES TO INDUSTRY FOR ENGAGING IN JOINT UNIVERSITY-BUSINESS RESEARCH

TABLE 3

PART IV: DETAILED STATISTICS BY SPECIALTY FIELD OF RESPONDENT

INCENTIVE TO INDUSTRY FOR ENGAGING IN RESEARCH WITH UNIVERSITY UNITS	AVERAGE RESPONSES**		RANK BY HI-TECH	CORRELATION	CHI-SQUARE
	Hi-Tech***	Busi-Soc			
1. State corporate income tax credit on R&D expenditures with state universities.	2.56	2.38	1.5	-.15	2.78
2. State assistance in financing new firms doing part of their R&D with universities.	2.54	2.26	3	-.21*	5.34
3. Corporation retaining patent rights to innovations developed by university researchers under contract with the company.	2.56	2.46	1.5	-.10	1.21
4. Low interest loans from State to firms to purchase research from State University System.	2.37	2.22	5	-.12	1.55
5. Increased quality of university faculty.	2.45	2.41	4	-.03	0.70
6. Increased accountability and control of university research projects.	1.69	1.59	7	-.08	1.80
7. State supported sources of managerial assistance for entrepreneurs.	1.60	1.81	8.5	+.16*	6.24*
8. State pays a portion of a company's expenditures on university research.	2.31	2.37	6	+.02	0.75
9. Develop educational programs in entrepreneurship.	1.60	1.85	8.5	+.16*	6.18*
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(64-67)	(47-50)			

*significant at a < .05

**range is from 1 (not responsive) to 3 (very responsive

***includes engineering, science, math and medicine

TABLE 4

RESPONSES TO UNIVERSITY QUESTIONNAIRE ITEMS CONCERNING SITUATION OR CONDITION AFFECTING JOINT RESEARCH

PART I: OVERALL STATISTICS

CONDITION WHICH MIGHT AFFECT JOINT RESEARCH	RESPONSE PERCENTAGES*					
	Not Barrier (1)	Minor Barrier (2)	Major Barrier (3)	OVERALL AVERAGE RESPONSE	RANK BY OVERALL AVERAGE	NUMBER WHO SELECTED AS MOST IMPORT.
1. Industrial emphasis on applied research. (132)	60	31	9	1.49	8	4
2. Time constraints of industrial research. (132)	23	63	14	1.92	3	4
3. Opportunity for involvement in real world problems. (131)	92	6	2	1.09	10	4
4. Capabilities/interests of industry scientists. (130)	66	27	7	1.41	9	2
5. Anti-academic attitudes of businessmen (129)	36	53	12	1.76	6	5
6. Business infringement on academic freedom. (128)	36	51	13	1.77	5	3
7. Division of Sponsored Research procedures (128)	42	47	11	1.69	7	1
8. Competition for industrial R&D by universities in other states. (128)	38	44	18	1.80	4	5
9. Available resources and student loads. (129)	12	37	50	2.38	1	25
10. Effectiveness of business-university communication. (127)	21	58	21	2.00	2	9

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*Actual number of respondents are shown in parentheses. Percentages sum to 100% (± 1% for rounding) for each row.

TABLE 4 RESPONSES TO UNIVERSITY QUESTIONNAIRE ITEMS CONCERNING SITUATION OR CONDITION AFFECTING JOINT RESEARCH

PART II: DETAILED STATISTICS BY TYPE OF UNIVERSITY

	CONDITION WHICH MIGHT AFFECT JOINT RESEARCH	AVERAGE RESPONSES**			RANK BY UF/FSU	CORRELATION	CHI-SQUARE
		UF/FSU	CF/SF	Others			
1.	Industrial emphasis on applied research.	1.69	1.31	1.40	7	-.20*	8.85
2.	Time constraints of industrial research.	1.94	1.86	1.93	3	-.01	4.78
3.	Opportunity for involvement in real world problems.	1.04	1.11	1.14	10	+.14	2.93
4.	Capabilities/interests of industry scientists.	1.31	1.35	1.57	9	+.17*	6.68
5.	Anti-academic attitudes of businessmen.	1.76	1.77	1.76	6	+.01	1.11
6.	Business infringement on academic freedom.	1.90	1.71	1.67	4	-.16*	3.99
7.	Division of Sponsored Research procedures.	1.78	1.63	1.63	5	-.09	7.91
8.	Competition for industrial R&D by universities in other states.	1.65	1.79	2.00	8	+.21*	9.23
9.	Available resources and student loads.	2.25	2.47	2.48	1	+.15*	4.33
10.	Effective of business-university communication	2.00	2.03	1.97	2	-.01	1.19
	(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(51-54)	(33-35)	(40-43)			

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*Significant at a < .05
**Range is from (1) Not a Barrier to (3) Major Barrier

RESPONSES TO UNIVERSITY QUESTIONNAIRE ITEMS CONCERNING SITUATION OR CONDITION AFFECTING JOINT RESEARCH

TABLE 4 PART III: DETAILED STATISTICS BY LEVEL OF R&D FUNDING BY INDUSTRY

CONDITION WHICH MIGHT AFFECT JOINT RESEARCH	None	Under $100K	Over $100K	RANK BY OVER $100k	CORRELATION	CHI-SQUARE
1. Industrial emphasis on applied research.	1.51	1.51	1.44	8	-.03	2.76
2. Time constraints of industrial research.	1.91	1.87	2.00	2	+.04	1.91
3. Opportunity for involvement in real world problems.	1.14	1.05	1.04	10	-.13	2.63
4. Capabilities/interests of industry scientists.	1.46	1.51	1.15	9	-.17*	8.74
5. Anti-academic attitudes of businessmen.	1.71	1.87	1.72	5	+.04	2.82
6. Business infringement on academic freedom.	1.67	1.86	1.88	3	+.14	5.88
7. Division of Sponsored Research procedures.	1.68	1.72	1.68	7	-.01	2.32
8. Competition for industrial R&D by universities in other states.	1.87	1.75	1.70	6	-.10	2.97
9. Available resources and student loads.	2.35	2.55	2.22	1	-.03	12.11*
10. Effectiveness of business-university communication.	2.08	2.00	1.80	4	-.15*	4.11
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(63-67)	(37-38)	(26-27)			

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*Significant at a < .05

**Range is from (1) Not a Barrier to (3) Major Barrier

RESPONSES TO UNIVERSITY QUESTIONNAIRE ITEMS CONCERNING SITUATION OR CONDITION AFFECTING JOINT RESEARCH
PART IV: DETAILED STATISTICS BY SPECIALTY FIELD OF RESPONDENT

TABLE 4

CONDITION WHICH MIGHT AFFECT JOINT RESEARCH	AVERAGE RESPONSES**				
	HI TECH***	BUSI-SOC	RANK BY HI-TECH	CORRELATION	CHI-SQUARE
1. Industrial emphasis on applied research.	1.58	1.40	8	-.12	2.76
2. Time constraints of industrial research.	1.84	1.98	4	+.12	1.77
3. Opportunity for involvement in real world problems.	1.06	1.10	10	+.06	1.34
4. Capabilities/interests of industry scientists.	1.37	1.42	9	+.04	1.70
5. Anti-academic attitudes of businessmen.	1.80	1.72	5	-.06	3.29
6. Business infringement on academic freedom.	1.90	1.59	3	-.23*	7.21*
7. Division of Sponsored Research procedures.	1.69	1.73	7	+.02	6.23*
8. Competition for industrial R&D by universities in other states.	1.77	1.80	6	+.01	0.94
9. Available resources and student loads	2.30	2.46	1	+.13	2.03
10. Effectiveness of business-university communication.	2.02	1.92	2	-.07	0.91
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(66-70)	(48-52)			

*significant at a < .05
**range is from (1) not a barrier to (3) major barrier
***includes Engineering, Science, Math and Medicine

BUSINESS ADMINISTRATOR QUESTIONNAIRE

In this section of the report the responses to the opinion portion of the questionnaire which was administered to the sample of business executives (see Chapter III for details of the sample) will be presented and discussed. Three different sets of opinion statements appear on the questionnaire and they are analyzed separately and presented as Tables "5," "6," and "7." The overall frequencies of responses are presented in Part I of each table and, on four separate pages, the average responses for various categories of four control variables are presented as Parts II, III, IV and V. These control variables are the "size," "ratio," "title," and "field" variables discussed in Chapter III.

Findings are based on an analysis approach which is repeated for each table. This approach focuses on certain "pointers" which indicate the possibility of an important distinction in the data. For the general frequencies (Part I) the pointers are: (1) rank order of average response to the items; (2) the absolute value of the averages; (3) the response to the question which followed each set of items and was worded "if one of these statements is clearly more important than the others, write the number of the response in the provided box." For the tables which present detailed statistics for categories of the control variables (Parts II, III, IV and V) the pointers are (1) rank order of the single site firms with sales under one million dollars/20% to 65% of employees engaged in R and D/Chief executive officer/science and engineering category and deviation of this ordering from the overall ranking; (2) pearson product moment zero-order correlation of the control variable categories by response categories; (3) chi-square value for the control categories by response categories table. The use of the pointers is judgmental--only the most certain, or extreme, of the findings will be discussed in this report.

Incentives for Businesses to Conduct R&D Work with Universities

Table 5, Part I, presents a summary of the responses to fourteen statements of alternative incentives to encourage business to conduct R&D work with universities. Across a 5-point response scale (1=very undesirable to 5=very desirable) the average item response ranged from 3.17 (#9) to 4.28 (#3).

Three incentives stand out as being most preferred by the sample of business executives. Each received approximately the same average response. "Corporate retention of patent rights" (#3) was ranked at the top with an average response of 4.28. "Increased faculty quality" (#5) and "State maintained listings of university capabilities" (#10) followed closely with average response levels of 4.26 and 4.23 respectively. The support for state maintained listings was particularly strong in that 18 (34%) of the 53 individuals ranking an item as "clearly more important" specified it.

The only other incentive with a response level above 4.00 was item #1, "state corporate income tax credit" which received an average of 4.08. It, however, was regarded as "clearly more important" by 8 individuals which placed it in second place behind item 10 in this ranking scheme.

"Business-university conferences" (#12) and "university research parks" (#6) received the next level of support with average response levels of 3.83 and 3.75. The next seven incentives were clustered together with average response levels ranging from 3.58 to 3.39. Included in this group were three items which involved some form of direct financial incentive for the company. There was a fourth gap in the average response levels between this group and the bottom ranked incentive, "sources of managerial assistance" (#9), which received an average of only 3.17.

On an overall basis it would appear that incentives, other than a tax credit, that involve some sort of direct financial inducement would not be the best approach for encouraging businesses to engage in joint research activity. Incentives involving state level coordination (#13) and increased project control (#7) are also without strong support.

Cross-classification of the overall frequencies by the four control variables (Table 5, Parts II, III, IV and V) lead to some significant changes in incentive ranking. These changes largely occur when company size is used as the control variable.

Table 5, Part II, shows that financial based incentives appear to be much more attractive to the small business executive associated with a single site operation which has sales of less than one million dollars. "State assistance in financing" (#12) moved from 13th in the overall rankings into a tie for second with "low interest loans" (#4) which came up from a tie for seventh place in the overall data. The average response level for both items was 4.18. Small businesses were also significantly more interested in "SBDCs providing R&D advising" (#11) and "educational programs in entrepreneurship" (#14) but these items were still not near the top of the rankings. At the same time, the small business executive seemed to be much less interested in patent rights (#3), which slipped from first into a tie for fifth, and somewhat less interested in faculty quality (#5) which went from second to fourth. This means, of course, that executives connected with larger firms gave stronger support to these two items than is indicated by the overall data. The larger firms also placed more emphasis on a State income tax credit (#1). Eleven of 31 responses from firms with annual sales of over ten million dollars rated this as a very desirable incentive (data not in tables). The tax credit received an average response of 4.32 from this subgroup.

The results of Part II of Table 5 indicate that the size of the target organizations should be given careful consideration when attempting to design a program to encourage joint research activity. A different approach would appear to be warranted for different company classes. The qualifications discussed in Chapter III regarding the limited sample size of firms in the lower sales volume category and the difficulties in accurately identifying firms that can be regarded as "emerging" or in the "startup" phase should again be noted.

No important distinctions can be drawn from the results obtained using the other three control variables. Table 5, Parts III, IV and V more closely replicate the overall rankings of Part I of Table 5. Any marked changes that occur are with respect to items that are not ranked in the top four positions.

Perceived Barriers to Joint Research with Universities

Table 6, Part I, lists eleven items which initial interviews and the literature suggested might be seen by businessmen as barriers to conducting joint research with universities. The condition receiving the number one ranking by the respondents, "lack of information about university research capabilities" (#9), was regarded as a major barrier on 51% of the questionnaires and had an average response of 2.37 on a three point scale.

Three diverse items ranked in the second through the fourth positions had almost equal average response levels. They were perceived as major barriers by between 46% and 39% of the respondents. "Lack of confidentiality of findings" (#7) had an average response of 2.26 while "lack of faculty interest" (#8) and "time required for results" (#2) had response levels of 2.24 and 2.20 respectively.

The next four barriers, with between 25% and 34% of the respondents regarding them as major barriers, received average response levels very close to 2.00. One of these barriers, "quality of Florida universities" (#10), received particular emphasis from a subset of the executives. It was regarded as "clearly more important" by 11 of the 48 respondents who designated an item in this manner. The number one barrier, on an average response basis, was so specified on eight of the questionnaires.

It is difficult to conclude, on the basis of the questionnaires, that any of listed items can be completely disregarded as a deterrent to joint research. Even the lowest ranked barriers, "cost of research" (#6), "emphasis on basic research" (#1) and "scientific equipment" (#5), had average response levels between 1.87 and 1.81 and were perceived as major barriers by between 31% and 21% of the business executives. All eleven items were regarded as a barrier by at least 50% of the respondents. The item ranked in the eleventh position was specified as either a major or minor barrier by 56% of those responding.

When the overall frequencies are cross-classified on the basis of firm size as a control variable, Table 6, Part II, there are several major changes in the rank ordering. Comparison of the rankings based on responses from single site firms with sales under one million dollars, against the overall data, shows that "cost of research" (#6) moved into a tie for second place from ninth place while "lack of information about research capabilities" (#9) dropped into a tie for fifth place from first place. Two other barriers, "quality of Florida universities" (#10) and "probability of return" (#11), both slipped by three positions in the rankings. These results should also be qualified by the sample size limitations discussed in Chapter III.

While the smallest firms in the sample appear more concerned with cost, their larger counterparts are more concerned about the quality of Florida's universities. This is underscored by examination of responses from firms with sales of over ten million dollars (data not in the tables). The 28 questionnaires from firms in this category had an average response level of 2.32 on item ten. The quality issue was listed as a major barrier on 12 of these questionnaires and eight specified the quality issue as "clearly more important." The larger firms' concern about quality is further emphasized by their significantly higher rating of item 5, "scientific equipment." These data provide additional evidence that there are significant differences between the perceptions of executives associated with different classes of business.

Cross-classification based on the other three control variables (Table 6, Parts III, IV and V) resulted in only minor differences in the rank orderings. One exceptions is found in the case of the "position" control variable (Part IV). The chief executive officers in the sample were significantly less concerned about "lack of confidentiality" (#7) than executives holding other positions in the firms.

Approaches to Strengthening Relationships between Industry and Universities

Table 7, Part I, presents the responses to twelve approaches industry might take to strengthen relations with universities. The data indicate that no item received an overall response close to the "very useful" (3.0) end of the scale; all were under 2.5. Item 12, "on site educational programs," did come close to this with an average response of 2.41. The data do show a considerable emphasis toward approaches that involve interaction between industry and university personnel. All five of the top ranked approaches, each with an average response of 2.13 or greater, describe such interaction.

Table 7, Parts II, III, IV and V, presents the results when the overall frequencies are cross-classified by the four control variables. While changes in the rank orderings are observed, none of the changes are associated with significant changes in average response levels.

TABLE 5

RESPONSES TO BUSINESS QUESTIONNAIRE ITEMS CONCERNING INCENTIVES FOR ENCOURAGING BUSINESSES TO CONDUCT R&D WORK WITH UNIVERSITIES
PART I: OVERALL STATISTICS

INCENTIVES FOR ENCOURAGING BUSINESSES TO CONDUCT R&D WORK WITH UNIVERSITIES	RESPONSE PERCENTAGES*					AVERAGE RESPONSE	RANK BY OVERALL AVERAGE	NUMBE WHO SELECTE AS MOST IMPORT.
	Very Undesirable (1)	Undesirable (2)	Not Relevant (3)	Desirable (4)	Very Desirable (5)			
1. State corporate income tax credit on R&D expenditures with state universities. (96)	1	1	18	49	31	4.08	4	8
2. State assistance in financing new firms doing part (94) of their R&D with universities.	5	11	35	37	12	3.39	13	1
3. Corporation retaining patent rights to innovations developed by university researchers under contract with the company. (97)	0	3	10	42	44	4.28	1	5
4. Low interest loans from State to firms to purchase research from State University System. (94)	1	10	33	43	14	3.58	7-8(tie)	4
5. Increased quality of university faculty. (92)	0	0	10	54	36	4.26	2	6
6. Establish university affiliated industrial/research parks with research facilities available for emerging firms. (95)	2	3	32	44	19	3.75	6	1
7. Increased accountability and control of university research projects. (93)	1	3	47	40	9	3.52	9	0
8. State pays a portion of a company's expenditures on university research. (93)	4	19	16	45	15	3.47	10	1
9. State supported sources of managerial assistance for entrepreneurs. (95)	3	17	44	32	4	3.17	14	1
10. State maintained listings of university research (94) expertise and experience.	0	0	8	60	32	4.23	3	16
11. Expand role of small business development centers to include R&D advising. (94)	1	9	31	47	12	3.58	7-8(tie)	0
12. State supported business-university research conferences. (93)	0	5	19	62	13	3.83	5	2
13. State level advisory/coordinating board for business-university R&D. (93)	5	14	22	52	8	3.42	12	0
14. Educational programs in entrepreneurship. (87)	1	13	39	35	13	3.45	11	4

Actual number of respondents are shown in parentheses. Percentages sum to 100% (± 1% for rounding) for each row.

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TABLE 5

RESPONSES TO BUSINESS QUESTIONNAIRE ITEMS CONCERNING INCENTIVES FOR ENCOURAGING BUSINESSES TO CONDUCT R&D WORK WITH UNIVERSITIES
PART II: DETAILED STATISTICS BY FIRM SIZE

INCENTIVES FOR ENCOURAGING BUSINESSES TO CONDUCT R&D WORK WITH UNIVERSITIES	Average Responses**			Rank by Single Site With Sales Under $1 M	Correlation	Chi-Square
	Single Site Operations					
	Sales Under $1 Million	Sales $1 to $10 Million	All Others			
1. State corporate income tax credit on R&D expenditures with state universities.	3.91	4.12	4.09	5-6 (Tie)	.06	8.47
2. State assistance in financing new firms doing part of their R&D with universities.	4.18	3.31	3.29	2-3 (Tie)	-.25*	9.94
3. Corporation retaining patent rights to innovations developed by university researchers under contract with the company.	3.91	4.12	4.37	5-6 (Tie)	.21*	13.27*
4. Low interest loans from State to purchase research from State University System.	4.18	3.94	3.41	2-3 (Tie)	-.33*	11.43
5. Increased quality of university faculty.	4.00	4.00	4.36	4	.24*	7.70
6. Establish university affiliated industrial/research parks with research facilities available for emerging firms.	3.82	3.94	3.68	8-10 (Tie)	-.09	5.11
7. Increased accountability and control of university research projects.	3.54	3.41	3.53	12	.02	1.75
8. State pays a portion of a company's expenditures on university research	3.80	3.62	3.38	11	-.132	9.77
9. State supported sources of managerial assistance for entrepreneurs.	3.40	3.41	3.06	11	-.17	11.81
10. State maintained listings of university research expertise and experience.	4.27	4.23	4.23	1	-.02	.63
11. Expand role of small business development centers to include R&D advising.	3.82	3.82	3.49	8-10 (Tie)	-.16	18.80*
12. State supported business-university research conferences.	3.82	3.59	3.89	8-10 (Tie)	.09	5.83
13. State level advisory/coordinating board for business-University R&D.	3.10	3.47	3.45	14	.08	3.47
14. Educational programs in entrepreneurship.	3.87	3.56	3.37	7	- .17	10.36
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(8-11)	(15-17)	(64-68)			

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*Significant at a < .05

**Range is from 1 (very undesirable) to 5 (very desirable)

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RESPONSES TO BUSINESS QUESTIONNAIRE ITEMS CONCERNING INCENTIVES FOR ENCOURAGING BUSINESSES TO CONDUCT R&D WORK WITH UNIVERSITIES

TABLE 5 PART III: DETAILED STATISTICS BY PROPORTION OF FIRM'S EMPLOYEES INVOLVED IN R&D

INCENTIVES FOR ENCOURAGING BUSINESSES TO CONDUCT R&D WORK WITH UNIVERSITIES	AVERAGE RESPONSES**					
	1% to 9%	10% to 19%	20% to 65%	RANK BY 20% to 65%	CORRELATION	CHI-SQUA
1. State corporate income tax credit on R&D expenditures with state universities.	4.00	4.28	4.06	4	.04	6.08
2. State assistance in financing new firms doing part of their R&D with universities.	3.31	3.06	3.61	8-9 (Tie)	.13	7.42
3. Corporation retaining patent rights to innovations developed by university researchers under contract with the company.	4.22	4.63	4.23	3	.01	6.11
4. Low interest loans from State to firms to purchase research from State University System.	3.24	3.94	3.87	5	.33*	15.34*
5. Increased quality of university faculty.	4.22	4.47	4.27	1	.04	2.73
6. Establish university affiliated industrial/research parks with research facilities available for emerging firms.	3.68	3.68	3.81	6	.06	6.50
7. Increased accountability and control of university research projects.	3.50	3.32	3.61	8-9 (Tie)	.06	8.00
8. State pays a portion of a company's expenditures on university research.	3.32	3.63	3.60	10	.12	6.22
9. State supported sources of managerial assistance for entrepreneurs.	3.13	3.15	3.19	14	.03	5.08
10. State maintained listings of university research expertise and experience.	4.24	4.36	4.26	2	.02	2.49
11. Expand role of small business development centers to include R&D advising.	3.58	3.61	3.54	11	-.01	8.40
12. State supported business-university research conferences.	3.78	4.00	3.76	7	.01	4.17
13. State level advisory/coordinating board for business-university R&D.	3.36	3.47	3.41	12	.02	8.07
14. Educational programs in entrepreneurship.	3.43	3.50	3.33	13	-.04	4.94
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(36-40)	(16-19)	(27-32)			

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*Significant at a < .05

**Range is from 1 (very undesirable) to 5 (very desirable)

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TABLE 5

RESPONSES TO BUSINESS QUESTIONNAIRE ITEMS CONCERNING INCENTIVES FOR ENCOURAGING BUSINESSES TO CONDUCT R&D WORK WITH UNIVERSITIES
PART IV: DETAILED STATISTICS BY POSITION IN CORPORATE HIERARCHY

	AVERAGE RESPONSES**				
INCENTIVES FOR ENCOURAGING BUSINESSES TO CONDUCT R&D WORK WITH UNIVERSITIES	Chief Executive Officer	Other Corporate Officers	RANK BY CHIEF EXECUTIVE	CORRELATION	CHI-SQUARE
1. State corporate income tax credit on R&D expenditures with state universities.	4.02	4.13	4	.07	2.58
2. State assistance in financing new firms doing part of their R&D with universities.	3.51	3.30	11	-.10	5.15
3. Corporation retaining patent rights to innovations developed by university researchers under contract with the company.	4.35	4.21	1	-.09	9.83*
4. Low interest loans from State to firms to purchase research from State University System.	3.71	3.48	6	-.13	11.17*
5. Increased quality of university faculty.	4.26	4.25	2	-.01	4.87
6. Establish university affiliated industrial/research parks with research facilities available for emerging firms.	3.70	3.77	7-8 (Tie)	.04	0.44
7. Increased accountability and control of university research projects.	3.50	3.49	12	.04	3.38
8. State pays a portion of a company's expenditures on university research.	3.70	3.28	7-8 (Tie)	-.19*	3.70
9. State supported sources of managerial assistance for entrepreneurs.	3.19	3.15	14	-.02	6.49
10. State maintained listings of university research expertise and experience.	4.20	4.25	3	.05	0.26
11. Expand role of small business development centers to include R&D advising.	3.68	3.50	9	-.10	4.90
12. State supported business-university research conferences.	3.80	3.84	5	.03	0.86
13. State level advisory/coordinating board for business-university R&D.	3.40	3.43	13	.02	1.53
14. Educational programs in entrepreneurship.	3.51	3.40	10	-.06	1.28
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(37-41)	(50-55)			

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*Significant at $a < .05$

**Range is from 1 (very undesirable) to 5 (very desirable)

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TABLE 5

RESPONSES TO BUSINESS QUESTIONNAIRE ITEMS CONCERNING INCENTIVES FOR ENCOURAGING BUSINESSES TO CONDUCT R&D WORK WITH UNIVERSITIES
PART V: DETAILED STATISTICS BY RESPONDENT"S COLLEGE FIELD

INCENTIVES FOR ENCOURAGING BUSINESSES TO CONDUCT R&D WORK WITH UNIVERSITIES	AVERAGE RESPONSE*		RANK BY SCIENCE AND ENGINEERING	CORRELATION	CHI-SQUARE
	Science or Engineering	Other Field			
1. State corporate income tax credit on R&D expenditures with state universities.	4.16	4.03	2-4 (Tie)	-.08	2.13
2. State assistance in financing new firms doing part of their R&D with universities.	3.51	3.46	9	-.02	2.64
3. Corporation retaining patent rights to innovations developed by university researchers under contract with the company.	4.16	4.40	2-4 (Tie)	.16	2.46
4. Low interest loans from State to firms to purchase research from State University System.	3.50	3.66	10	.10	2.72
5. Increased quality of university faculty.	4.25	4.22	1	-.02	1.56
6. Establish university affiliated industrial/research parks with research facilities available for emerging firms.	3.85	3.64	6	-.11	5.08
7. Increased accountability and control of university research projects.	3.56	3.62	8	.04	1.78
8. State pays a portion of a company's expenditures on university research.	3.59	3.41	7	-.08	4.51
9. State supported sources of managerial assistance for entrepreneurs.	3.13	3.18	14	.03	3.54
10. State maintained listings of university research expertise and experience.	4.16	4.13	2-4 (Tie)	-.02	0.62
11. Expand role of small business development centers to include R&D advising.	3.27	3.67	13	.22*	3.79
12. State supported business-university research conference.	3.86	3.82	5	-.03	1.60
13. State level advisory/coordinating board for business-university R&D.	3.40	3.45	12	.02	0.38
14. Educational programs in entrepreneurship.	3.41	3.37	11	-.03	1.96
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(35-37)	(27.31)			

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*Significant at a < .05

**Range is from 1 (very undesirable) to 5 (very desirable)

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RESPONSES TO BUSINESS QUESTIONNAIRE ITEMS CONCERNING SITUATION OR CONDITION AFFECTING JOINT RESEARCH

TABLE 6

PART I: OVERALL STATISTICS

	CONDITION WHICH MIGHT AFFECT JOINT RESEARCH	RESPONSE PERCENTAGES * NOT A BARRIER (1)	MINOR BARRIER (2)	MAJOR BARRIER (3)	AVERAGE RESPONSE	RANK BY OVERALL AVERAGE	NUMBER WHO SELECTED AS MOST IMPORT.
1.	University emphasis on basic research. (91)	43	30	28	1.85	10	3
2.	Time required for results from university research. (92)	16	48	36	2.20	4	7
3.	Theoretical emphasis in university research. (92)	27	50	23	1.96	8	1
4.	Industrial experience of university researchers. (91)	33	36	31	1.98	6	3
5.	Scientific equipment of universities.(90)	43	32	24	1.81	11	1
6.	Cost of university research. (87)	31	51	18	1.87	9	1
7.	Lack of confidentiality of university research findings. (91)	15	43	42	2.26	2	7
8.	Lack of interest of faculty in business problems. (87)	13	51	37	2.24	3	2
9.	Lack of information about university research capabilities. (91)	13	36	51	2.37	1	8
10.	Quality of Florida universities as compared to those of other states. (88)	28	47	25	1.97	7	11
11.	Probability of return from university research. (84)	20	58	21	2.01	5	3

*Actual number of respondents are shown in parentheses. Percentages sum to 100% (± 1% for rounding) for each run.

TABLE 6

RESPONSES TO BUSINESS QUESTIONNAIRE ITEMS CONCERNING SITUATION OR CONDITION AFFECTING JOINT RESEARCH
PART II: DETAILED STATISTICS BY FIRM SIZE

	CONDITION WHICH MIGHT AFFECT JOINT RESEARCH	AVERAGE RESPONSES **					
		SINGLE SITE OPERATIONS					
		Sales Under $1 Million	Sales $1 to $10 Million	All Others	RANK BY SINGLE SITE WITH SALES UNDER $1 M	CORRELATION	CHI-SQUARE
1.	University emphasis on basic research.	1.63	1.73	1.92	9	.13	2.32
2.	Time required for results from university research.	2.18	2.13	2.23	2-3(tie)	.04	0.45
3.	Theoretical emphasis in university research.	1.90	1.93	1.98	7	.04	0.96
4.	Industrial experience of university researchers.	2.00	2.00	1.98	5-6(tie)	-.01	0.46
5.	Scientific equipment of universities.	1.27	1.60	1.97	10-11(tie)	.31*	10.43*
6.	Cost of university research.	2.18	1.84	1.84	2-3(tie)	-.14	6.34
7.	Lack of confidentiality of university research findings.	2.27	2.06	2.30	1	.06	1.74
8.	Lack of interest of faculty in business problems.	2.10	2.53	2.20	4	-.04	4.44
9.	Lack of information about university research capabilities.	2.00	2.53	2.40	5-6(tie)	.12	5.85
10.	Quality of Florida universities as compared to those of other states.	1.27	1.93	2.10	10-11(tie)	.35*	13.42*
11.	Probability of return from university research.	1.7	1.85	2.10	8	.19*	4.47
	RANGE OF ACTUAL NUMBER OF RESPONDENTS	(9-11)	(13-15)	(60-65)			

*Significant at a <.05

**Range is from 1 (not a barrier) to 3 (major barrier).

RESPONSES TO BUSINESS QUESTIONNAIRE ITEMS CONCERNING SITUATION OR CONDITION AFFECTING JOINT RESEARCH

TABLE 6 PART III: DETAILED STATISTICS BY PROPORTION OF FIRM'S EMPLOYEES INVOLVED IN R & D

CONDITION WHICH MIGHT AFFECT JOINT RESEARCH	AVERAGE RESPONSES **					
	1% to 9%	10% to 19%	20% to 65%	RANK BY 19% TO 65%	CORRELATION	CHI-SQUARE
1. University emphasis on basic research.	1.89	1.89	1.79	10	-.05	1.27
2. Time required for results from university research.	2.35	2.15	2.06	4	-.18*	3.19
3. Theoretical emphasis in university research.	1.94	2.15	1.86	8-9(tie)	-.04	2.78
4. Industrial experience of university researchers.	1.97	2.15	1.90	6-7(tie)	-.03	3.60
5. Scientific equipment of universities.	2.02	1.66	1.66	11	-.20*	5.26
6. Cost of university research.	1.91	1.94	1.86	8-9(tie)	-.03	0.21
7. Lack of confidentiality of university research findings.	2.36	2.15	2.26	1	-.06	3.35
8. Lack of interest of faculty in business problems.	2.27	2.29	2.21	2	-.04	0.80
9. Lack of information about university research capabilities.	2.48	2.68	2.13	3	-.21*	8.76
10. Quality of Florida universities as compared to those of other states.	2.00	2.15	1.90	6-7(tie)	-.06	4.74
11. Probability of return from university research.	2.00	2.27	1.92	5	-.04	6.34
RANGE OF ACTUAL NUMBER OF RESPONDENTS	(33-38)	(17-19)	(27-30)			

* Significant at a < .05

**Range is from 1 (not a barrier) to 3 (major barrier

RESPONSES TO BUSINESS QUESTIONNAIRE ITEMS CONCERNING SITUATION OR CONDITION AFFECTING JOINT RESEARCH

TABLE 6

PART IV: DETAILED STATISTICS BY POSITION IN CORPORATE HIERARCHY

	AVERAGE RESPONSES **				
CONDITION WHICH MIGHT AFFECT JOINT RESEARCH	CHIEF EXECUTIVE OFFICER	OTHER CORPORATE OFFICER	RANK BY CHIEF EXECUTIVE	CORRELATION	CHI-SQUARE
1. University emphasis on basic research.	2.00	1.73	8	-.16	2.58
2. Time required for results from university research.	2.17	2.20	3	.02	0.33
3. Theoretical emphasis in university research.	2.02	1.90	5-7(tie)	-.08	1.66
4. Industrial experience of university researchers.	2.02	1.94	5-7(tie)	-.05	0.25
5. Scientific equipment of universities.	1.67	1.92	11	.15	2.16
6. Cost of university research.	1.92	1.83	9	-.06	1.12
7. Lack of confidentiality of university research findings.	2.03	2.44	5-7(tie)	.29*	7.84*
8. Lack of interest of faculty in business problems.	2.21	2.26	2	.04	0.67
9. Lack of information about university research capabilities.	2.35	2.38	1	.02	0.14
10. Quality of Florida universities as compared to those of other states.	1.92	2.00	10	-.05	0.59
11. Probability of return from university research.	2.02	2.00	4	-.02	0.18
RANGE OF ACTUAL NUMBER OF RESPONDENTS	(34-40)	(49-53)			

*Significant at a < .05

**Range is from 1 (not a barrier) to 3 (major barrier)

RESPONSES TO BUSINESS QUESTIONNAIRE ITEMS CONCERNING SITUATION OR CONDITION AFFECTING JOINT RESEARCH

TABLE 6

PART V: DETAILED STATISTICS BY RESPONDENT'S COLLEGE FIELD

CONDITION WHICH MIGHT AFFECT JOINT RESEARCH	SCIENCE OR ENGINEERING	OTHER FIELD	RANK BY SCIENCE OR ENGINEERING	CORRELATION	CHI-SQUARE
1. University emphasis on basic research.	1.73	2.03	11	.18	2.29
2. Time required for results from university research.	2.21	2.23	3	.01	0.16
3. Theoretical emphasis in university research.	1.86	1.96	9	.07	1.69
4. Industrial experience of university researchers.	2.00	2.06	5-6(tie)	.04	3.47
5. Scientific equipment of universities.	1.86	1.93	10	.04	1.46
6. Cost of university research.	1.91	1.89	8	-.02	1.96
7. Lack of confidentiality of university research findings.	2.24	2.48	2	.18	2.17
8. Lack of interest of faculty in business problems.	2.17	2.35	4	.14	1.33
9. Lack of information about university research capabilities.	2.30	2.36	1	.04	0.15
10. Quality of Florida universities as compared to those of other states.	2.00	1.96	5-6(tie)	-.02	1.42
11. Probability of return from university research.	1.94	2.07	7	.11	1.20
RANGE OF ACTUAL NUMBER OF RESPONDENTS	(34-37)	(27-31)			

*Significant at a <.05
**Range is from 1 (not a barrier) to 3 (major barrier)

TABLE 7

RESPONSES TO BUSINESS QUESTIONNAIRE ITEMS CONCERNING APPROACHES TO STRENGTHENING RELATIONSHIPS BETWEEN INDUSTRY AND UNIVERSITIES
PART I: OVERALL STATISTICS

APPROACHES TO STRENGTHENING RELATIONSHIPS BETWEEN INDUSTRY AND UNIVERSITIES	RESPONSE PERCENTAGES* Not Useful (1)	Somewhat Useful (2)	Very Useful (3)	AVERAGE RESPONSE	RANK BY OVERALL AVERAGE	NUMBER WHO SELECTED AS MOST IMPORT.
1. University faculty and company research staff exchanges. (92)	21	46	34	2.13	5	2
2. Faculty internships with industry. (93)	15	44	41	2.26	3	5
3. Industry scientists and engineers teach in universities. (93)	13	53	34	2.21	4	6
4. Industry supported or endowed research professorship. (92)	28	59	13	1.85	12	1
5. Joint employment of nationally recognized researcher. (90)	26	54	20	1.94	9	2
6. Direct company contribution to selected university components. (90)	16	66	19	2.03	6	0
7. University use of industrial research and/or computer facilities. (91)	25	54	21	1.96	8	1
8. Establish scholarships. (91)	31	49	20	1.89	10	0
9. Company personnel serve on university advisory boards. (93)	16	38	46	2.30	2	8
10. Industry consortia support for basic research in universities (92)	25	49	26	2.01	7	0
11. Joint library holdings of academic and trade publications. (91)	33	48	19	1.86	11	0
12. Develop on site educational programs for industry personnel. (92)	10	39	51	2.41	1	12

*Actual Number of Respondents are shown in parentheses. Percentages sum to 100% (± 1% for rounding) for each row.

TABLE 7

RESPONSES TO BUSINESS QUESTIONNAIRE ITEMS CONCERNING APPROACHES TO STRENGTHENING RELATIONSHIPS BETWEEN INDUSTRY AND UNIVERSITIES

PART II: DETAILED STATISTICS BY ARM SIZE

	AVERAGE RESPONSES**					
	Single Site Operations					
APPROACHES TO STRENGTHENING RELATIONSHIPS BETWEEN INDUSTRY AND UNIVERSITIES	Sales Under $1 Million	Sales $1 to $10 Million	All Others	RANK BY SINGLE SITE WITH SALES UNDER $1M	CORRELATION	CHI-SQUARE
1. University faculty and company research staff exchanges.	1.81	1.86	2.23	8-10 (Tie)	.23*	7.90
2. Faculty internships with industry.	2.00	2.20	2.30	3-4 (Tie)	.14	13.14*
3. Industry scientists and engineers teach in universities.	2.36	1.86	2.27	1	.05	17.38*
4. Industry supported or endowed research professorship.	1.63	2.00	1.84	12	.06	2.48
5. Joint employment of nationally recognized researcher.	1.70	1.71	2.00	11	.18	4.90
6. Direct company contribution to selected university components.	1.81	2.00	2.07	8-10 (Tie)	.14	5.53
7. University use of industrial research and/or computer facilities.	2.00	2.06	1.90	3-4 (Tie)	-.07	5.00
8. Establish scholarships.	1.90	1.86	1.86	5-6 (Tie)	-.01	4.72
9. Company personnel serve on university advisory boards.	1.90	2.26	2.35	5-6 (Tie)	.19*	4.43
10. Industry consortia support for basic research in universities.	1.81	2.26	1.96	8-10 (Tie)	.00	4.01
11. Joint library holdings of academic and trade publications.	1.90	2.06	1.78	7	-.11	3.84
12. Develop on site educational programs for industry personnel.	2.10	2.20	2.49	2	.22*	8.45
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(10-11)	(14-15)	(63-65)			

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*Significant at a < .05

**Range is from 1 (not useful) to 3 (very useful)

TABLE 7

RESPONSES TO BUSINESS QUESTIONNAIRE ITEMS CONCERNING APPROACHES TO STRENGTHENING RELATIONSHIPS BETWEEN INDUSTRY AND UNIVERSITIES

PART III: DETAILED STATISTICS BY PROPORTION OF FIRM'S EMPLOYEES INVOLVED IN R&D

APPROACHES TO STRENGTHENING RELATIONSHIPS BETWEEN INDUSTRY AND UNIVERSITIES	AVERAGE RESPONSES**			RANK BY 20% to 65%	CORRELATION	CHI-SQUARE
	1% to 9%	10% to 19%	20% to 65%			
1. University faculty and company research staff exchanges.	2.05	1.89	2.26	2	.12	5.21
2. Faculty internships with industry.	2.22	2.21	2.23	3	.01	1.97
3. Industry scientists and engineers teach in universities.	2.36	2.05	2.16	5	-.14	7.07
4. Industry supported or endowed research professorship.	1.82	1.73	1.90	11	.05	1.54
5. Joint employment of nationally recognized researcher.	1.94	1.82	2.03	7	.06	1.50
6. Direct company contribution to selected university components.	2.00	2.10	1.96	9-10 (Tie)	.02	1.57
7. University use of industrial research and/or computer facilities.	1.91	1.89	2.00	8	.05	9.00
8. Establish scholarships.	1.76	1.84	1.96	9-10 (Tie)	.13	8.71
9. Company personnel serve on university advisory boards.	2.33	2.36	2.20	4	-.08	4.00
10. Industry consortia support for basic research in universities.	2.00	1.68	2.13	6	.07	9.96*
11. Joint library holdings of academic and trade publications.	1.85	1.73	1.89	12	.02	1.73
12. Develop on site educational programs for industry personnel.	2.41	2.42	2.41	1	.00	1.76
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(34-36)	(17-19)	(29-30)			

*Significant at a < .05
**Range is from 1 (not useful) to 3 (very useful)

TABLE 7

RESPONSES TO BUSINESS QUESTIONNAIRE ITEMS CONCERNING APPROACHES TO STRENGTHENING RELATIONSHIPS BETWEEN INDUSTRY AND UNIVERSITIES
PART IV: DETAILED STATISTICS BY POSITION IN CORPORATE HIERARCHY

	AVERAGE RESPONSES**				
APPROACHES TO STRENGTHENING RELATIONSHIPS BETWEEN INDUSTRY AND UNIVERSITIES	Chief Executive Officer	Other Corporate Executive	RANK BY CHIEF EXECUTIVE	CORRELATION	CHI-SQUARE
1. University faculty and company research staff exchanges.	1.97	2.25	8	.19*	3.25
2. Faculty internships with industry.	2.15	2.34	4	.13	3.04
3. Industry scientists and engineers teach in universities.	2.10	2.30	5-6 (Tie)	.15	3.23
4. Industry supported or endowed research professorship.	1.80	1.88	12	.07	2.26
5. Joint employment of nationally recognized researcher.	1.97	1.92	9	-.04	2.15
6. Direct company contribution to selected university components.	2.15	1.94	3	-.18*	3.95
7. University use of industrial research and/or computer facilities.	2.10	1.84	5-6 (Tie)	-.19*	3.22
8. Establish scholarships.	1.85	1.92	11	.05	0.26
9. Company personnel serve on university advisory boards.	2.22	2.35	2	.09	1.11
10. Industry consortia support for basic research in universities.	2.05	1.98	7	-.05	0.64
11. Joint library holdings of academic and trade publications.	1.87	1.84	10	-.02	0.19
12. Develop on site educational programs for industry personnel.	2.25	2.52	1	.20*	5.37
(RANGE OF ACTUAL NUMBER OF RESPONSES)	(39-40)	(51-53)			

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*Significant at a ≤ .05

**Range is from 1 (not useful) to 3 (very useful)

RESPONSES TO BUSINESS QUESTIONNAIRE ITEMS CONCERNING APPROACHES TO STRENGTHENING RELATIONSHIPS BETWEEN INDUSTRY AND UNIVERSITIES

TABLE 7

PART V: DETAILED STATISTICS BY RESPONDENT'S COLLEGE FIELD

APPROACHES TO STRENGTHENING RELATIONSHIPS BETWEEN INDUSTRY AND UNIVERSITIES	AVERAGE RESPONSE*		RANK BY SCIENCE OR ENGINEERING	CORRELATION	CHI-SQUARE
	Science or Engineering	Other Field			
1. University faculty and company research staff exchanges.	2.16	2.12	2-3 (Tie)	-.02	5.10
2. Faculty internships with industry.	2.13	2.40	4-5 (Tie)	.19	2.48
3. Industry scientists and engineers teach in universities.	2.16	2.28	2-3 (Tie)	.09	1.84
4. Industry supported or endowed reseach professorship.	1.91	1.74	8	-.14	2.42
5. Joint employment of nationally recognized researcher.	1.85	2.16	10	.22*	3.15
6. Direct company contribution to selected university components.	1.88	1.96	9	.07	1.29
7. University use of industrial research and/or computer facilities.	1.80	2.03	11-12 (Tie)	.16	2.21
8. Establish scholarships.	1.80	1.83	11-12 (Tie)	.03	1.22
9. Company personnel serve on university advisory boards.	2.13	2.46	4-5 (Tie)	.23*	3.47
10. Industry consortia support for basic research in universities.	1.94	1.90	6	-.03	2.17
11. Joint library holdings of academic and trade publications.	1.94	1.77	7	-.11	0.98
12. Develop on site educational programs for industry personnel.	2.48	2.50	1	.01	2.20
(RANGE OF ACTUAL NUMBER OF RESPONDENTS)	(34-36)	(29-32)			

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*Significant at a < .05

**Range is from 1 (not useful) to 3 (very useful)

COMPARISON OF UNIVERSITY AND BUSINESS QUESTIONNAIRE RESPONSES

While major segments of the two questionnaires are not directly comparable, there are areas where meaningful comparisons can be made. In particular, it is possible to obtain some feeling for the degree to which the industry and university groups agree on major barriers to, as well as desirable incentives for encouraging, joint research activity.

A good measure of the extent of agreement between industry and universities on the issue of joint research may be obtained via comparison of the attitudes of businessmen toward various incentives designed to encourage their participation (See Table 5, Part I) with the beliefs of university administrators about the responsiveness of industry to many of these same incentives (See Table 3, Part I). While the two lists are not identical (nine of the 14 incentives offered to businessmen comprise the group evaluated by university personnel) areas of both agreement and disagreement are seen to exist.

The three top ranked industry inducements, ordered by average response, on the university evaluated list are three of the top four items on the industry evaluated list. "Corporate retention of patent rights" is first on both lists, while "increased faculty quality," which is the second most favored incentive for businessmen, appears in third place in the university ordering. The concept of a "state corporate income tax credit for R&D expenditures" is ranked fourth on the industry list while it is in second position on the university list. The item ranked in third place by businessmen, "listings of university research capabilities," does not appear on the comparable university list. It did appear in another part of the university questionnaire (See Table 1, Part I) where it received solid support despite being ranked in the middle of the list of State actions to facilitate joint research.

There are also several agreements at the lower end of the ranking of industry incentives. The three items ranked at the bottom by university administrators, "educational programs in entrepreneurship," "sources of managerial assistance" and "increased accountability and control," were not strongly supported by industry personnel.

There was not, however, complete agreement by the two groups on incentives that would be effective in encouraging industry participation. Substantial conflict is found in the area of direct financial incentives. "State assistance in financing," "State pays a portion of a company's research expenditures" and "low interest loans," while ranked in the middle of the university ordering of industry incentives, all received strong support in terms of average response. However, each of these incentives were ranked in the very bottom cluster of the alternatives reviewed by businessmen. It should be recalled, nevertheless, that cross-classification of the overall industry frequencies by the "size" control variable indicated that these alternatives were favored by the smaller business firms.

Perhaps the most significant conflict between the perceptions of university and industry interests is in the use of research parks to stimulate joint research activity. The use of university affiliated research parks is ranked, by university administrators, as the number one State action to facilitate joint research (See Table 1, Part I). The average response of 2.58 afforded this item is biased toward the "very useful" (3.0) category. Industry response to this issue was marginal at best. It ranked sixth in the 14 incentives ranked by businessmen (See Table 5, Part I) and received an average response well below that given the three top ranked items. Only 19% of the business executives regarded research parks as "very desirable" while fully 65% of the university respondents regarded them as "very useful." Twenty-three university administrators selected research parks as "clearly more important" than any of the other items appearing on the same list. Given that the research park concept is primarily aimed at "emerging firms," this conflict of opinion should be qualified by the limitations noted in Chapter 3. It is suspected that a significant number of "emerging firms" were not represented in the sample of firms. At any rate, it is difficult to determine from the available data exactly what the attitude of such firms would be to the research park concept.

Communication is seen as a significant consideration by both industry and university personnel. This is reflected in the response to a number of questionnaire items that are either directly involved with, or related to, communication. The sample of industry executives viewed "lack of information about university research capabilities" and "lack of faculty interest" as the number one and the number three barriers to joint research (See Table 6). At the same time the industry executives placed "listings of university research expertise" very close to the top of their list of incentives and gave some support to "business-university research conferences" which was in fourth place in the same category (See Table 5). In addition, as noted earlier in this chapter, all five of the top ranked approaches for industry to strengthen relations with universities involved personnel interaction (See Table 7).

University administrators also recognized the importance of the communication issue. "Listings of industrial research needs" was tied for first place, on the basis of average response, in the set of incentives for university personnel (See Table 2). Table 1 shows that "research staff exchanges," business-university research conferences" and "listings of university research expertise" all received strong average responses as desirable State actions to facilitate joint research. These alternatives were ranked in the second, fourth and fifth places respectively in their category. In addition, university administrators viewed "effectiveness of business-university communications" as the number two item in their set of barriers to joint research (See Table 4).

The communication barrier exists despite the presence of a number of mechanisms designed to eliminate it. A positive aspect of the communication difficulty is that it represents a problem area that has the potential of being alleviated with relatively little financial expenditure.

It should be noted that there is some considerable difference in the structure of the barriers the two groups perceive as impeding their participation in joint research activity. In the case of the university administrators, the situation is relatively simple. It is basically a problem of available resources. As pointed out earlier in this chapter this is clearly the most significant barrier in the minds of university personnel. It would also appear that additional resources would help reduce other barriers that received high absolute rankings. These include barriers ranked in positions two, three and four -- "effectiveness of business-university communication," "time constraints of industrial research" and "competition from universities in other states."

The barriers perceived by industry are much more complex. A number of different barriers are regarded as significant by a substantial number of businessmen. Eight of the eleven barriers listed in the business questionnaire received an average response of 1.90 or higher on a three point scale. The average response across all items was slightly above 2.00. In contrast, only three of the ten barriers listed in the university questionnaire received an average response exceeding 1.90 and the average across all items was less than 1.80. One positive point can be noted here: it would appear that a number of the higher ranked industrial barriers could be attacked with relatively low cost programs.

CHAPTER V

CONCLUSIONS

OVERVIEW OF CONCLUSIONS

In Chapter I of this report, the four major questions for the research were stated. In this chapter, the evidence discussed and presented in chapters II, III and IV is assessed and is summarized in terms of tentative answers to these questions. The first question was, should SUS research units, become more involved in joint R&D projects with Florida high-technology firms? The general conclusion of this research is that Florida's universities should become more involved in research projects with the State's high technology industry. This conclusion follows directly from the widely recognized role of higher education in the development of this industry and its key role in recent and future economic growth. In order to maintain an outstanding record of economic development, the State must be prepared to fully utilize the State University System as one means of maximizing its ability to attract and nurture high technology companies. This type of activity has received wide support within the State. For example, all three regional input conferences for the recently drafted SUS master plan called for increased university-industry linkages to allow University research to be a primary factor in attracting and supporting high technology.

The nature of the response to the study's two questionnaires suggest that the second question should also be answered affirmatively. Given proper conditions, it is reasonable to anticipate that SUS research units would become more involved in joint research and development projects. Both universities and high technology companies stand to benefit from this increased interaction. This expectation is consistent with the National Science Foundation's estimate of a four fold increase in industrial spending on university research during the last decade (Business Week, 1982). NSF anticipates that this spending rate will continue to increase.

Questions concerning just how much of an increase in joint research activity is appropriate and how to best go about achieving it are much more difficult to resolve. This results partly from the fact that the use of the university system to encourage high tech development is not without significant risks that must be carefully considered. For example, attempts to implement the high cost strategies through significant reallocation of education dollars would impair the quality of education and basic research in areas not directly related to the selected high technology fields. The long run cost of such action could far exceed benefits gained.

The balance of this chapter will review and comment on various strategies that are suggested by the response to items on the two questionnaires, concluding with overall program recommendations.

Strategies for encouraging joint university-industry research and development projects that received the strongest questionnaire support are summarized in Table 8. The strategies are based on questionnaire items associated with both facilitating actions and actions designed to eliminate perceived barriers. The first column of the table specifies strategies drawn from the university administrator's questionnaire while the second column contains strategies based on the corporate survey.

The table also classifies the strategies on the basis of a combination of estimated implementation cost (low, intermediate, and high) and whether the strategy can be expected to yield results in the short run (3 years or less) or in the long run. A high cost, short run category does not exist in the table since it was assumed that financial constraints would force high cost strategies to be implemented over the longer time frame. It is recognized that this strategy classification is not mutually exclusive in that most strategies will have some effect in both the long and short run. In addition, implementation cost will vary substantially with different approaches to implementing a strategy.

STRATEGIES FOR ENCOURAGING UNIVERSITY-INDUSTRY RESEARCH BASED ON QUESTIONNAIRE RESPONSE AND CLASSIFIED BY COST OF IMPLEMENTATION AND TIME REQUIRED TO OBTAIN RESULTS

TABLE 8

	From University Questionnaire	From Industry Questionnaire
Low Cost/ Short Run	1. Establish clear State University System policy on industry-university research activity 2. Improve communication a. Lists of university research expertise and industrial research needs b. Research staff exchanges c. Business-university research conferences 3. Reduce red tape a. Relax procurement regulations b. Expand overload allowances 4. Research parks	1. Patent rights and confidentiality 2. Improve communication a. List of university research expertise b. Stimulate faculty interest in business problems c. Company personnel serve on advisory board d. Research staff exchanges e. Business-university research conferences f. Faculty internship g. Industry Scientist teach in Universities
Intermediate Cost/Short run	1. State funding earmarked for support of university-industry research activity	1. Direct financial incentives a. State income tax credit b. Low interest loans to purchase research from SUS c. State assistance in financing new firms doing R&D with universities
High Cost/ Long Run	1. Expand resources and reduce student loads 2. On site technical education	1. Increase faculty and university quality 2. On site technical education

UNIVERSITY QUESTIONNAIRE SPECIFIED STRATEGIES

Establish Clear SUS Policy (Low Cost/ Short Run)

Establishing clear State University System policy to guide university-industry research activity is of utmost importance. It is a low cost step that should yield almost immediate returns. The importance of this action goes well beyond the traditional benefits associated with policy formulation.

The importance of clear SUS policy is emphasized in the literature and stressed by a number of questionnaire respondents. Most of these concerns directly involve, or are related to, the traditional educational and basic research roles of the university. There are dangers associated with undertaking a substantial effort directed at increasing university involvement in industrial research and development projects. These dangers are underscored by the existence of a series of University Presidents Conferences on this subject (Business Week, 1982).

The State University System must decide how much and what type of work the universities can do, within the limits of existing resources, without doing serious damage to their basic missions --damage that could far exceed returns anticipated from increased industrial involvement. This critical policy decision should not be made by the top SUS administrators alone. It is recommended that a series of conferences involving all university presidents, or their designees, meet with top SUS personnel on this matter. The policy established should be as general as possible and allow maximum flexibility of action at each university.

Improve Communication (Low Cost/Short Run)

A frequently recurring theme in the literature is that joint research activity would increase if communication and interaction between university and industry personnel could be improved. This position is supported by the responses to both the university and the industry questionnaires. A number of items directly or indirectly related to improving communication were strongly supported. These included the maintenance of lists of both university research capabilities and industrial research needs, research staff exchanges, business-university research conferences and on-site technical education. These communication shortcomings have been recognized by State officials and business leaders and noted in the new SUS master plan.

Reduce Red Tape (Low Cost/Short Run)

A number of the sampled individuals were emphatic in expressing their objection to State regulations which, in their view, significantly hinder efforts to engage in industrial research and consulting activity. Three individuals observed that there were very real dissincentives for a faculty member to contract for research through the university, while one respondent stressed that the State should facilitate rather than hinder such activity.

The overall response to two questionnaire items directly related to red tape (expand overload allowances and relax State procurment regulations) emphasize difficulties in this area. This viewpoint is perhaps more strongly reflected in the very negative response to the use of a State level advisory/coordinating body for business-university research. It received the lowest average response level on the list of nine different State actions to facilitate joint research. It is suspected that the negative response resulted from viewing this as one more source of red tape.

While it is certainly a well worn recommendation, the State may well be able to significantly improve joint research activity by carefully reviewing procedural barriers, such as the extensive procurement process.

Research Parks (Low Cost/Short Run)

The use of University affiliated research parks to faciliate joint research activity received very strong support from university personnel. This would probably be classified as a long run alternative if it were not for the fact that a number of parks have already been planned and development efforts are well underway. It is classified as a low cost alternative because the development approaches being used do not involve substantial direct cost to the State.

The most negative aspect of this alternative is the lack of interest expressed by the sample of industry executives. As noted in chapter 4, however, it is difficult to evaluate this alternative since it is not possible to determine the attitude of "emerging" or "start-up" firms to the research park concept. On the positive side is the significant amount of national publicity this effort has received and the attention it has brought to Florida's effort in high tech development. additional State legislation in support of this approach is still needed and is well documented in the "Doables" recommendation.

Funding Earmarked for Support of Joint Research (Intermediate Cost/Short Run)

State funding earmarked for supporting university-industry research activity received favorable support from university administrators. The questionnaire provided no indication of just how these funds would be used. This may partly explain the positive support. The response to the item can also be viewed, however, as further endorsement of increased joint R&D activity.

Expand Resources and Reduce Student Loads (High Cost/Long Run)

The relationship between available resources and student loads was clearly regarded as the number one problem. Resource availability must be sharply improved if any program to increase joint research activity is to achieve a substantial degree of success. All low cost, short run, alternatives will achieve very limited gains in the absence of increases in resources relative to student loads. The provision of these resources will also serve to improve faculty and university quality which is among the most significant barriers as perceived by the business executives.

The need for adequate research facilities is a key aspect of the resource expansion requirement. It is clear that university research requires state-of-the-art facilities if it is to be competitive in the market place. The literature contends that university research equipment is not competitive. This is emphasized by the National Science Foundation.

University administrators were not asked if they believed their laboratory equipment and research space represented a barrier to joint research. Six individuals, however, attached comments stressing that they regarded the research facilities as a critical problem. This group included a university president, an associate dean, a director of sponsored research and three department heads. They urged that this matter be given immediate attention. It was also pointed out that the accelerating rate of technological obsolence of the facilities was accompanied by a rapidly increasing cost of maintaining state-of-the-art research equipment.

Business executives were asked if they regarded the scientific equipment of Florida's universities as a barrier to joint research. On the basis of the overall response, scientific equipment ranked last among the eleven barriers listed. It is suspected that this ranking is at least partly the result of the fact that a large number of the sampled firms are not on the cutting edge of research in their particular field. This position receives support from the fact that the larger firms (annual sales of more than 50 million dollars) were significantly more concerned about the state of university facilities. Nine of the 18 firms in this group regarded it as a major barrier.

If Florida is to attract state-of-the-art high tech companies which will provide faculty with the most appropriate type of research opportunities and which will form the core around which other firms will locate, it is necessary to provide appropriate equipment and sufficient amounts of high quality research space.

On Site Technical Education (High Cost/Long Run)

University administrators and business executives both regard the existence of readily available on site technical education as a fruitful avenue to improving communication and increasing joint research activity. Such a program already exists and its importance appears to be recognized. The program must be expanded, however, to meet existing demand and anticipated demand increases.

The main function of this program extends beyond its proven success in encouraging joint research activity. It should be pointed out that the continued rate of increase in technological progress makes the availability of such training one of the most critical elements in the competition for high technology industry.

BUSINESS QUESTIONNAIRE SPECIFIED STRATEGIES

Patent Rights and Confidentiality (Low Cost/Short Run)

The results from the business questionnaire and the university questionnaire indicate that the patent rights and confidentiality issues are sensitive areas. Corporate executives are clearly interested in retaining patent rights to results from joint or contracted research activity. At the same time a number of university administrators strongly oppose granting full patent rights to the corporation. It was argued that the best approach, and one frequesntly used, is to negotiate patent rights as part of the research agreement. This appears to be appropriate since it does not eliminate a significant incentive for faculty participation nor does it remove an important potential university income source that can be used to support basic research. Patent rights were viewed as a low cost alternative since there was no direct outlay of State funds.

The confidentiality question is sensitive since it has a bearing on academic freedom. It is clear, however that faculty members can encourage joint research activity if they are willing to sacrafice, at least in the short run, part of their publication rights and if they take steps to maintain confidentiality of key results.

Communication (Low Cost/Short Run)

A wide range of alternative approaches to facilitating communication were supported by the sample of industry executives. A list of these approaches appears in Table 8.

Direct Financial Incentives (Intermediate Cost/Short Run)

The use of direct financial incentives (such as tax credits, low interest loans to purchase research, or financing assistance for new firms) to encourage joint research activity is very difficult to evaluate and is an area where the State should be particularly cautious.

The need for caution is based on several considerations. In the first place, direct financial incentives were not top ranked in terms of questionnaire response. In addition, as pointed out in Chapter 4, there was considerable difference in preference for financial alternatives between large and small firms. Large firms were oriented in favor of a tax credit approach while small firms favored financing assistance for new firms and low interest loans to purchase university research. It is evident that firms in the early stages of development would have little interest in a tax credit. At this point, it would be unlikely that there would be any profits against which the tax credit could be applied. Financing assistance would probably be their primary concern. Design of a program of direct financial incentives should be accompanied by a decision on the type of firm the State wishes to see entering joint research ventures with a university.

It is recommended that any financial incentive program be initially approached on a very limited, experimental basis. If firms in the earlist stages of development are to be targeted by this program, university research parks could be utilized in the experimentation.

Quality of Faculty and Universities (High Cost/Long Run)

Results from the business questionnaire indicate that increased business-university research would be one of many dividends associated with the increased quality that many have advocated. In evaluating the extent to which perceived university quality serves as a barrier to joint research, it should be recalled that all questionnaires in the business survey were returned by Florida based companies or branches. It is reasonable to assume that companies outside of the State would view faculty quality as an even more critical barrier.

The importance of the university quality factor to state-of-the-art, high technology firms cannot be overemphasized. This can be placed in perspective by examining the study of high technology industry location decisions conducted for the for the Joint Economic Committee of the U.S. Congress (U.S. Congress, 1982f). The study shows that the quality of academic institutions in the Southeast (data not available for Florida alone) is a very critical barrier to the location of firms in this area. The Southeast received an extremely favorable rating on three of the four factors which the study identified as most important in the high technology firm's decision. The Southeast, however, received an extremely low rating on the fourth factor, academic institutions. Only 29% of 691 responding executives regarded the region's academic institutions as either excellent or good. Only one of the seven regions, Mountain and Plains, had a lower evaluation. The remaining five regions had sharply higher ratings with between 41% and 97% of the respondents classifying institutions in the excellent or good categories.

If it is assumed that Florida is on par with the rest of the Southeast in terms of labor cost/availability, labor productivity, and tax climate, it can be argued that Florida has the opportunity to become one of the most, if not the most, attractive area for high technology industry location. This would require that Florida achieve a substantial improvement in the perceived quality of its academic institutions.

One important consideration on the quality issue should be noted. Several individual questionnaire respondents argued that it would be a serious mistake for the State to atempt to develop more than one nationally recognized, broad based, high technology center capable of helping to attract and support state-of-the-art companies. Dr. Carmen J. Palermo, Vice President Chief Scientist, Government Sector of Harris Corporation, stressed that if the State wished to establish more than one center it must be approached on a selective basis. Different universities would specialize in specified sectors. Financial realities would probably leave little choice in this matter. Careful analysis of existing university capabilities and industry opportunities must precede this selection.

Some university personnel contend that we now have quality high technology research capability within the university system. This is difficult to establish, and it may or may not be the case. If it is true, however, the communication problem, and the resources relative to student load problem, are of even greater consequence.

On Site Technical Education (High Cost/Long Run)

See discussion under the same heading in the University Questionnaire Specified Strategies section of this chapter; both sets of conclusions are presented at that point.

STATE LEVEL ADVISORY BOARD RECOMMENDATION

Both the sample of university administrators, and the sample of business executives, did not have favorable opinions of a State level advisory/coordinating board for business-university R&D. The item received an average response that placed it last on the university list of nine State actions to facilitate research activity, while it was ranked 12th out of the 14 actions appearing on the industry questionnaire. A large part of the negative reaction may have been based on viewing the board as an unnecessary control and as another source of red tape.

Certain aspects of the responses, however, indicated the existence of an advisory board would be necessary. Both groups were receptive to some of the functions that might be assigned to the board--such as maintenance of lists of university research capabilities and industry needs. Several university administrators reported they had found boards they had formed were helpful in improving communication and stimulating business-university research activity. Industry feedback indicated that they viewed participation on university advisory boards as one of the best approaches to strengthening relations between the two groups.

The SUS Master Plan recommends formation of an industry/academic council and steps are being taken to create it. This action is supported as a logical part of a strategy for encouraging business-university research. It is recommended that its assignments include responsibility for facilitating communication and identifying research areas deserving attention. The board should study and recommend alternative strategies to encourage joint research activity. It should both encourage formation of and support local advisory boards. The State board should be positioned to recommend, not establish, policy.

SUMMARY OF RECOMMENDATIONS

A number of strategies for enhancing joint research activity have been discussed in this chapter. They are among the extensive suggestions made in the literature and/or advanced by individuals in Florida. Each of strategies appeared on the study's two questionnaires and all but one of them (state level advisory board) received strong support from the sampled university administrators and business executives.

It is recommended that all of the low cost, short run alternatives discussed be implemented as soon as possible. For significant, long run improvement in joint research activity, these actions must be coupled with several high cost programs. There must be an improved balance between available resources and student loads and a strengthening of university system quality. These high cost strategy components will yield benefits well beyond the stimulation of research activity. For example, there should be an accompanying improvement in the quality of university graduates which will serve as a further attraction for high technology industry. The positive committment of the State to this program will, along with the actual changes, contribute to gradual improvement in the university and industry confidence needed to effect desired results.

As stressed earlier, these strategies must be preceded by policy decisions on the role of Florida universities in high technology development and must be achieved through the allocation of new resources. To do otherwise would run a significant risk of incurring costs that would far exceed any benefits derived from increased business-university research activity.

The proposed program is summarized as follows:

A. Low Cost/Short Run.

  1. Establish clear University System policy for university-industry research activity.
  2. Improve communication.
     a. Maintain lists of university research expertise and industrial needs.
     b. Encourage interaction of research staffs.
     c. Hold business-university research conferences.
  3. Establish State level advisory board and encourage development of local boards.
  4. Negotiate patent rights and maintain confidentiality of research results.
  5. Support development of research parks.
  6. Reduce red tape.
     a. Relax procurement regulations.
     b. Expand overload allowances.

B. Intermediate Cost/Short Run.

  1. Earmark funds for support of joint research.
  2. Provide direct financial incentives (select target firm type and start with experimental program).

C. High Cost/Long Run.

  1. Expand university resources (includes improvement in research facilities) and reduce student loads.
  2. Establish state-of-the-art research facilities.
  3. Improve quality of faculty and universities.
  4. Expand on site technical education.

APPENDICES I, II, III

MAIL QUESTIONNAIRE COVER LETTERS, ENVELOPE FORMAT, INSTRUMENTS AND POST CARD FOLLOW-UP

UNIVERSITY OF NORTH FLORIDA
4567 ST. JOHNS BLUFF ROAD, S. JACKSONVILLE, FLORIDA 32216
DEPARTMENT OF BUSINESS ADMINISTRATION
904-646-2780

(COVER LETTER FOR UNIVERSITY ADMINISTRATORS)

Through the Office of the Governor and Florida's Department of Commerce, we have received a grant to conduct a study of university involvement in private sector research and development. The enclosed questionnaire will take no more than 15 minutes to complete. Please fill out the form and use the postage paid reply envelope to return it.

If increased business-university research is feasible and desirable, the State would like to take appropriate steps to encourage it. Since we are surveying only selected administrators in the State University System, it is important to obtain replies from them all.

If for any reason you cannot fill out the questionnaire, please indicate the reason on the form and return it to us. If you believe that someone other than yourself should fill out the questionnaire, by all means ask that person to do so.

A recent amendment to Florida Statutes, Chapter 240.241, permits us to keep all responses confidential and we will do so.

If you would like to receive a copy of the summary of our study, check the box on the last page of the questionnaire. If you have any questions, please call or write us.

Thank you,

Steven K. Paulson
Director of Research

Robert C. Pickhardt
Professor of Management Science

An Equal Opportunity Institution

UNIVERSITY OF NORTH FLORIDA
4567 ST. JOHNS BLUFF ROAD, S. JACKSONVILLE, FLORIDA 32216

DEPARTMENT OF BUSINESS ADMINISTRATION
904-646-2780

(COVER LETTER FOR BUSINESS ADMINISTRATORS)

We have been asked by the Office of the Governor and Florida's Department of Commerce, to provide information which will allow Florida to pursue its goal of facilitating the formation and growth of high technology firms. The enclosed questionnaire, which should take no more than 15 minutes to complete, is designed to supply part of this information. Please fill out the form and use the reply envelope to return it.

The specific subject of the study is joint business-university research. If there are ways in which Florida firms can make use of university research capabilities, the State would like to improve their economic feasibility.

We are surveying only a relatively small number of firms, hence it is important to obtain replies from all of them. We would prefer for the form to be completed by a top executive who is close to the research and development function, or who would be in a position to assess the potential of joint business-university research.

If for any reason you feel that the form cannot be filled out, please indicate the reason on the form and return it to us.

A recent amendment to Florida Statutes, Chapter 240.241, permits us to keep all responses confidential and we will do so.

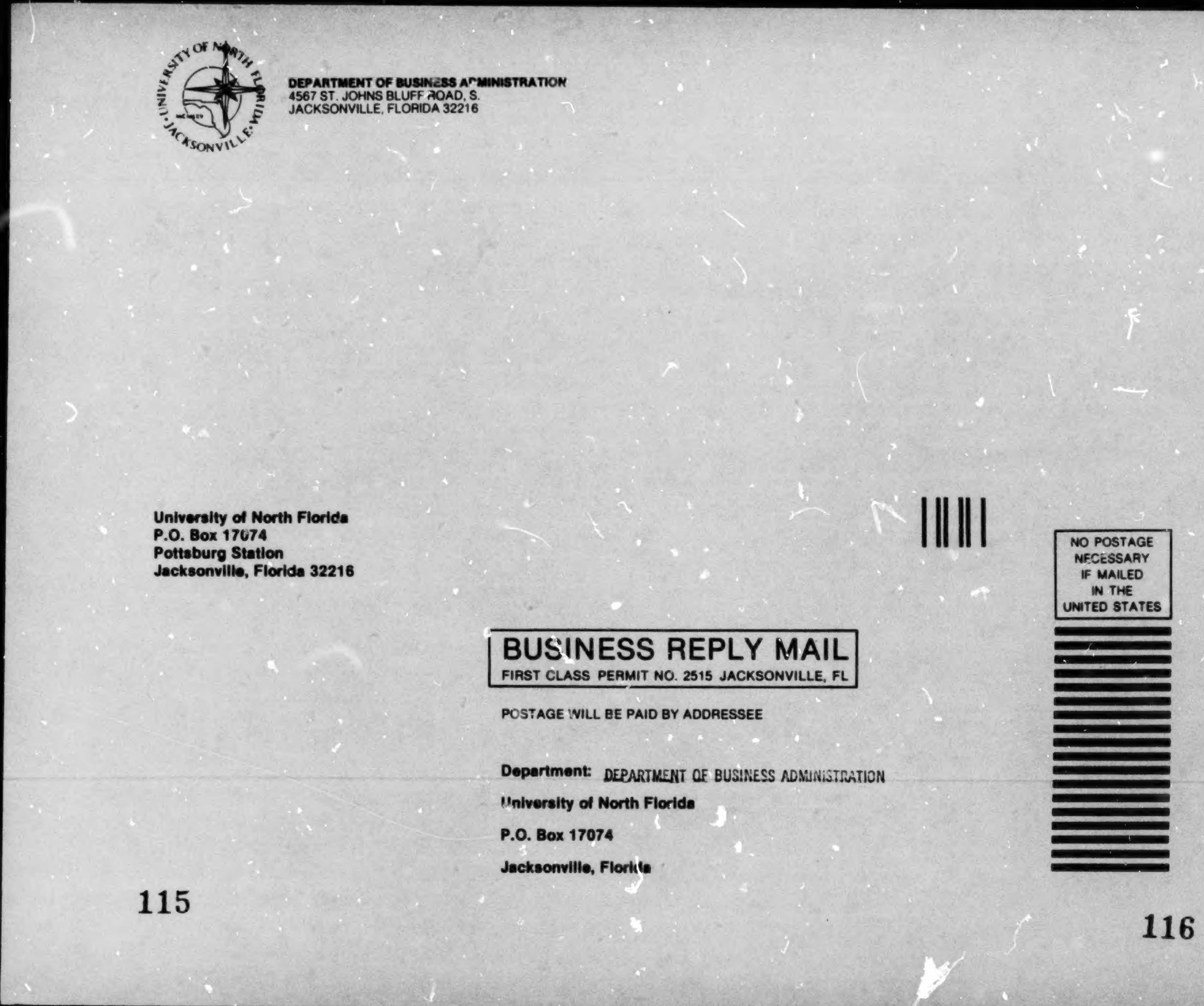
If you would like to receive a copy of the summary of our study, check the box on the last page of the questionnaire. If you have any questions, please call or write us.

Thank you,

Steven K. Paulson, Ph.D.
Director of Research

Robert C. Pickhardt, Ph.D.
Professor of Management Science

ENVELOPE FORMATS USED IN CONJUNCTION WITH MAIL QUESTIONNIARE



MAILOUT

DEPARTMENT OF BUSINESS ADMINISTRATION
4567 ST. JOHNS BLUFF ROAD, S.
JACKSONVILLE, FLORIDA 32216

University of North Florida
P.O. Box 17074
Pottsburg Station
Jacksonville, Florida 32216

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UNITED STATES

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Department: DEPARTMENT OF BUSINESS ADMINISTRATION
University of North Florida
P.O. Box 17074
Jacksonville, Florida

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UNIVERSITY-BUSINESS RESEARCH SURVEY

NAME OF PERSON COMPLETING SURVEY: ____________________ UNIVERSITY: ____________________

POSITION: ____________________ LENGTH OF TIME HELD: ____________________ (years)

UNIT (DEPARTMENT OR COLLEGE) AFFILIATION: ____________________ LENGTH OF AFFILIATION: ____________________ (years)

YOUR HIGHEST EDUCATIONAL DEGREE: ____________________ FIELD: ____________________

HOW LONG HAVE YOU LIVED IN FLORIDA: ____________________ (years)

WHAT IS THE APPROXIMATE AMOUNT OF FUNDS WHICH YOUR UNIT WILL HAVE RECEIVED THIS YEAR (1982-83) FROM INDUSTRIAL RESEARCH CONTRACTS? $__________

A NUMBER OF DIFFERENT INCENTIVES FOR ENCOURAGING UNIVERSITY PERSONNEL TO ENGAGE IN R&D ACTIVITY WITH BUSINESSES HAVE BEEN DISCUSSED. FOR EACH OF THE FOLLOWING, INDICATE HOW RESPONSIVE PERSONNEL IN YOUR UNIT MIGHT BE. (check one box for each statement)

	INCENTIVES FOR ENGAGING IN JOINT UNIVERSITY-BUSINESS RESEARCH	IN A UNIVERSITY UNIT LIKE MINE THE INCENTIVE WOULD BE				
		VERY DESIRABLE	DESIRABLE	NOT RELEVANT	UN-DESIRABLE	VERY UN-DESIRABLE
1.	More credit given toward tenure and promotion for R&D work with private sector.	☐	☐	☐	☐	☐
2.	State maintained listings of industrial research needs.	☐	☐	☐	☐	☐
3.	University retaining some interest in patents from work done by university researchers for industry.	☐	☐	☐	☐	☐
4.	Release time for establishing industrial contacts.	☐	☐	☐	☐	☐
5.	Establish clear State University System policy on industry-university research activity.	☐	☐	☐	☐	☐
6.	Expand salary overload allowances.	☐	☐	☐	☐	☐
7.	Relax state procurement regulations.	☐	☐	☐	☐	☐
8.	Other (please specify) ____________________					

IF YOU FEEL THAT ANY ONE OF THE STATEMENTS IS CLEARLY MORE IMPORTANT THAN THE REST, WRITE THE NUMBER OF THE STATEMENT HERE. ☐

FOR EACH OF THE FOLLOWING SITUATIONS OR CONDITIONS, GIVE YOUR OPINION OF HOW MUCH OF A BARRIER IT WOULD BE FOR JOINT UNIVERSITY-BUSINESS RESEARCH PROJECTS, FOR A UNIVERSITY UNIT LIKE YOURS IN FLORIDA. (check one box for each statement)

		FOR A UNIVERSITY UNIT LIKE MINE THE SITUATION OR CONDITION WOULD BE		
	SITUATION OR CONDITION AFFECTING RESEARCH	MAJOR BARRIER TO JOINT RESEARCH	MINOR BARRIER TO JOINT RESEARCH	NOT A BARRIER TO JOINT RESEARCH
1.	Industrial emphasis on applied research.	☐	☐	☐
2.	Time constraints of industrial research.	☐	☐	☐
3.	Opportunity for involvement in real world problems.	☐	☐	☐
4.	Capabilities/interests of industry scientists.	☐	☐	☐
5.	Anti-academic attitudes of businessmen.	☐	☐	☐
6.	Business infringement on academic freedom.	☐	☐	☐
7.	Division of Sponsored Research procedures.	☐	☐	☐
8.	Competition for industrial R&D by universities in other states.	☐	☐	☐
9.	Available resources and student loads.	☐	☐	☐
10.	Effectiveness of business-university communication.	☐	☐	☐
11.	Other (please specify) ______________________			

IF YOU FEEL THAT ANY ONE OF THE ABOVE STATEMENTS IS CLEARLY MORE IMPORTANT THAN THE REST, WRITE THE NUMBER OF THE STATEMENT HERE. ☐

A NUMBER OF STATE SUPPORTED ACTIONS ARE AVAILABLE THAT COULD FACILITATE INDUSTRY-UNIVERSITY RESEARCH ACTIVITY. FOR A UNIT LIKE YOURS HOW USEFUL WOULD EACH OF THE FOLLOWING BE IN FACILITATING SUCH ACTIVITY? (check one box for each statement)

		FOR A UNIT LIKE MINE THE STATE ACTION WOULD BE		
	TYPE OF STATE ACTION TO FACILITATE INDUSTRY-UNIVERSITY RESEARCH	VERY USEFUL	SOMEWHAT USEFUL	NOT USEFUL
1.	State maintained listing of university research expertise and experience.	☐	☐	☐
2.	State supported business-university research conferences.	☐	☐	☐
3.	State level advisory/coordinating body for business-university research.	☐	☐	☐
4.	Establish university mechanisms for coordinating and controlling industrial research activity.	☐	☐	☐
5.	Faculty-company research staff exchanges.	☐	☐	☐
6.	Include R&D advising in role of small business development centers.	☐	☐	☐
7.	On site technical education of industry personnel.	☐	☐	☐
8.	State funding earmarked for supporting university-industry research activity.	☐	☐	☐
9.	Establish university affiliated research parks with research facilities available for emerging firms.	☐	☐	☐
10.	Other (please specify) ______________________			

IF YOU FEEL THAT ANY ONE OF THE ABOVE STATEMENTS IS CLEARLY MORE IMPORTANT THAN THE REST, WRITE THE NUMBER OF THE STATEMENT HERE. ☐

A NUMBER OF SUGGESTIONS HAVE BEEN MADE REGARDING STEPS THE STATE COULD TAKE TO ENCOURAGE INDUSTRY (BOTH NEW OR EMERGING COMPANIES AND ESTABLISHED COMPANIES) TO CONDUCT PART OF THEIR RESEARCH THROUGH THE UNIVERSITY SYSTEM. FOR EACH OF THE FOLLOWING INCENTIVES, INDICATE HOW RESPONSIVE YOU THINK FLORIDA FIRMS WOULD BE (check one box for each statement).

	INCENTIVES TO INDUSTRY FOR ENGAGING IN JOINT UNIVERSITY-BUSINESS RESEARCH	INDUSTRY WOULD BE:		
		VERY RESPONSIVE	SOMEWHAT RESPONSIVE	NOT RESPONSIVE
1.	State corporate income tax credit on R&D expenditures with state universities.	☐	☐	☐
2.	State assistance in financing new firms doing part of their R&D with universities.	☐	☐	☐
3.	Corporation retaining patent rights to innovations developed by university researchers under contract with the company.	☐	☐	☐
4.	Low interest loans from State to firms to purchase research from State University System.	☐	☐	☐
5.	Increased quality of university faculty.	☐	☐	☐
6.	Increased accountability and control of university research projects.	☐	☐	☐
7.	State supported sources of managerial assistance for entrepreneurs.	☐	☐	☐
8.	State pays a portion of a company's expenditures on university research.	☐	☐	☐
9.	Develop educational programs in entrepreneurship.	☐	☐	☐
10.	Other (please specify) ______________________			

IF YOU FEEL THAT ANY ONE OF THE ABOVE STATEMENTS IS CLEARLY MORE IMPORTANT THAN THE REST, WRITE THE NUMBER OF THE STATEMENT HERE. ☐

IN WHAT WAYS HAS YOUR UNIT BEEN INVOLVED IN RESEARCH RELATIONSHIPS WITH FLORIDA INDUSTRIES? (PLEASE PROVIDE AS MUCH DETAIL AS POSSIBLE BELOW AND ON THE REVERSE SIDE OF THE PAGE OR ATTACH EXISTING DOCUMENTS).

IN WHAT WAYS HAS YOUR UNIT BEEN INVOLVED IN RESEARCH RELATIONSHIPS WITH INDUSTRIES OUTSIDE THE STATE OF FLORIDA? (PLEASE PROVIDE AS MUCH DETAIL AS POSSIBLE BELOW AND ON THE REVERSE SIDE OF THE PAGE OR ATTACH EXISTING DOCUMENTS).

IF YOU HAVE ANY OTHER COMMENTS OR SUGGESTIONS THAT YOU FEEL ARE RELEVANT TO THE TOPIC OF INDUSTRY-UNIVERSITY RESEARCH ACTIVITY, PLEASE MAKE THEM ON THE BACK OF THIS PAGE.

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THANK YOU FOR YOUR HELP WITH OUR STUDY. USE THE ENCLOSED REPLY ENVELOPE OR MAIL TO DEPARTMENT OF BUSINESS ADMINISTRATION, UNF, JACKSONVILLE, FLORIDA 32216. IF YOU WOULD LIKE TO RECEIVE A COPY OF OUR RESULTS SUMMARY, CHECK THIS BOX. ☐

BUSINESS-UNIVERSITY RESEARCH SURVEY

YOUR NAME: ______________________ COMPANY NAME: ______________________

POSITION: ______________________ LENGTH OF TIME HELD ____________ (years)

HOW LONG HAVE YOU BEEN EMPLOYED IN FLORIDA? ____________ (years) WHAT IS YOUR AGE? ____________ (years)

WHAT COLLEGE DEGREES DO YOU HOLD? ______________________ (Degrees and fields)

HOW WOULD YOU DESCRIBE YOUR PLANT OR OFFICE FACILITY (check one)?

☐ headquarters for a multisite operation
☐ branch of a multisite operation or subsidiary
☐ single site operation

WHAT IS YOUR ESTIMATE OF THE TOTAL NUMBER OF EMPLOYEES AT THIS SITE? ______________________ (total number of employees)

HOW MANY EMPLOYEES, AT THIS SITE, WOULD YOU ESTIMATE TO BE INVOLVED IN RESEARCH AND DEVELOPMENT ACTIVITY AS SCIENTISTS, ENGINEERS, OR TECHNICIANS? ______________________ (Total number of scientists, engineers and technicians)

WHAT WAS THE TOTAL 1982 SALES VOLUME ASSOCIATED WITH THIS SITE? (check one)

☐ under $500,000
☐ 501,000 - 999,999
☐ 1 - 10 million $
☐ 11 - 50 million
☐ 51 - 100 million
☐ 101 - 250 million
☐ 251 - 499 million
☐ Over $500 million
☐ unable to estimate site sales

A NUMBER OF DIFFERENT INCENTIVES FOR ENCOURAGING BUSINESSES TO CONDUCT R&D WORK WITH UNIVERSITIES, ALONG WITH STEPS THAT MIGHT BE TAKEN TO FACILITATE THIS INTERACTION, HAVE BEEN DISCUSSED. FOR EACH OF THE FOLLOWING, INDICATE HOW RESPONSIVE A COMPANY LIKE YOURS MIGHT BE (check one box for each statement).

	INCENTIVES FOR ENGAGING IN JOINT UNIVERSITY-BUSINESS RESEARCH	FOR A COMPANY LIKE MINE THE INCENTIVE WOULD BE				
		VERY DESIRABLE	DESIRABLE	NOT RELEVANT	UNDESIRABLE	VERY UNDESIRABLE
1.	State corporate income tax credit on R&D expenditures with state universities.	☐	☐	☐	☐	☐
2.	State assistance in financing new firms doing part of their R&D with universities.	☐	☐	☐	☐	☐
3.	Corporation retaining patent rights to innovations developed by university researchers under contract with the company.	☐	☐	☐	☐	☐
4.	Low interest loans from State to firms to purchase research from State University System.	☐	☐	☐	☐	☐
5.	Increased quality of university faculty.	☐	☐	☐	☐	☐
6.	Establish university affiliated industrial/research parks with research facilities available for emerging firms.	☐	☐	☐	☐	☐
7.	Increased accountability and control of university research projects.	☐	☐	☐	☐	☐
8.	State pays a portion of a company's expenditures on university research.	☐	☐	☐	☐	☐

		FOR A COMPANY LIKE MINE THE INCENTIVE WOULD BE				
	INCENTIVES FOR ENGAGING IN JOINT UNIVERSITY-BUSINESS RESEARCH	VERY DESIRABLE	DESIRABLE	NOT RELEVANT	UNDESIRABLE	VERY UNDESIRABLE
9.	State supported sources of managerial assistance for entrepreneurs.	☐	☐	☐	☐	☐
10.	State maintained listings of university research expertise and experience.	☐	☐	☐	☐	☐
11.	Expand role of small business development centers to include R&D advising.	☐	☐	☐	☐	☐
12.	State supported business-university research conferences.	☐	☐	☐	☐	☐
13.	State level advisory/coordinating board for business-university R&D.	☐	☐	☐	☐	☐
14.	Educational programs in entrepreneurship.	☐	☐	☐	☐	☐
15.	Other (please specify) ____________________					

IF YOU FEEL THAT ANY ONE OF THE ABOVE STATEMENTS IS CLEARLY MORE IMPORTANT THAN THE REST, WRITE THE NUMBER OF THE STATEMENT HERE. ☐

FOR EACH OF THE FOLLOWING SITUATIONS OR CONDITIONS, GIVE YOUR OPINION ON HOW MUCH OF A BARRIER IT WOULD BE (FOR JOINT BUSINESS-UNIVERSITY RESEARCH PROJECTS), FOR A COMPANY LIKE YOURS IN FLORIDA (check one box for each statement).

		FOR A COMPANY LIKE MINE THE SITUATION OR CONDITION WOULD BE		
	SITUATION OR CONDITION AFFECTING RESEARCH	MAJOR BARRIER TO JOINT RESEARCH	MINOR BARRIER TO JOINT RESEARCH	NOT A BARRIER TO JOINT RESEARCH
1.	University emphasis on basic research.	☐	☐	☐
2.	Time required for results from university research.	☐	☐	☐
3.	Theoretical emphasis in university research.	☐	☐	☐
4.	Industrial experience of university researchers.	☐	☐	☐
5.	Scientific equipment of universities.	☐	☐	☐
6.	Cost of university research.	☐	☐	☐
7.	Lack of confidentiality of university research findings.	☐	☐	☐
8.	Lack of interest of faculty in business problems.	☐	☐	☐
9.	Lack of information about university research capabilities.	☐	☐	☐
10.	Quality of Florida universities as compared to those of other states.	☐	☐	☐
11.	Probability of return from university research.	☐	☐	☐
12.	Other (please specify) ____________________			

IF YOU FEEL THAT ANY ONE OF THE ABOVE STATEMENTS IS CLEARLY MORE IMPORTANT THAN THE REST, WRITE THE NUMBER OF THE STATEMENT HERE. ☐

A NUMBER OF DIFFERENT APPROACHES TO STRENGTHENING RELATIONSHIPS BETWEEN INDUSTRY AND UNIVERSITIES HAVE BEEN USED. FOR EACH OF THE FOLLOWING, GIVE YOUR OPINION OF HOW USEFUL THE APPROACH WOULD BE FOR A COMPANY LIKE YOURS (check one box for each statement).

INDUSTRY APPROACH TO STRENGTHENING INDUSTRY-UNIVERSITY RELATIONS	FOR A COMPANY LIKE MINE THIS APPROACH WOULD BE		
	VERY USEFUL	SOMEWHAT USEFUL	NOT USEFUL
1. University faculty and company research staff exchanges.	☐	☐	☐
2. Faculty internships with industry.	☐	☐	☐
3. Industry scientists and engineers teach in universities.	☐	☐	☐
4. Industry supported or endowed research professorship.	☐	☐	☐
5. Joint employment of nationally recognized researcher.	☐	☐	☐
6. Direct company contribution to selected university components.	☐	☐	☐
7. University use of industrial research and/or computer facilities.	☐	☐	☐
8. Establish scholarships.	☐	☐	☐
9. Company personnel serve on university advisory boards.	☐	☐	☐
10. Industry consortia support for basic research in universities.	☐	☐	☐
11. Joint library holdings of academic and trade publications.	☐	☐	☐
12. Develop on site educational programs for industry personnel.	☐	☐	☐
13. Other (please specify) ______________________			

IF YOU FEEL THAT ANY ONE OF THE ABOVE STATEMENTS IS CLEARLY MORE IMPORTANT THAN THE REST, WRITE THE NUMBER OF THE STATEMENT HERE. ☐

IN WHAT WAYS HAS YOUR FIRM BEEN INVOLVED IN A RESEARCH RELATIONSHIP WITH UNIVERSITIES IN FLORIDA? (PLEASE PROVIDE AS MUCH DETAIL AS POSSIBLE BELOW AND ON THE REVERSE SIDE OF THE PAGE).

IN WHAT WAYS HAS YOUR FIRM BEEN INVOLVED IN A RESEARCH RELATIONSHIP WITH UNIVERSITIES OUTSIDE THE STATE OF FLORIDA? (PLEASE PROVIDE AS MUCH DETAIL AS POSSIBLE BELOW AND ON THE REVERSE SIDE OF THE PAGE).

IF YOU HAVE ANY OTHER COMMENTS OR SUGGESTIONS THAT YOU FEEL ARE RELEVANT TO THE TOPIC OF INDUSTRY-UNIVERSITY RESEARCH ACTIVITY, PLEASE MAKE THEM ON THE BACK OF THIS PAGE. IN ADDITION, IF YOUR COMPANY IS NOW WELL ESTABLISHED, BUT YOU HAD EXPERIENCE DURING THE START-UP PHASE OF THE ORGANIZATION, PLEASE INDICATE WHAT INCENTIVES WOULD HAVE BEEN HELPFUL AT THAT TIME.

IF YOU HAVE ANY OTHER COMMENTS OR SUGGESTIONS THAT YOU FEEL ARE RELEVANT TO THE TOPIC OF INDUSTRY-UNIVERSITY RESEARCH ACTIVITY, PLEASE WRITE THEM ON THIS PAGE. IN ADDITION, IF YOUR COMPANY IS NOW WELL ESTABLISHED, BUT YOU HAD EXPERIENCE DURING THE START-UP PHASE OF THE ORGANIZATION, PLEASE INDICATE WHAT INCENTIVES WOULD HAVE BEEN HELPFUL AT THAT TIME.

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POST CARD REMINDER FORMAT USED IN CONJUNCTION WITH MAIL QUESTIONNAIRE

May 9, 1983

Last week a questionnaire seeking your opinion about industry-university joint research was mailed to you.

If you have already completed and returned it to us, please accept our sincere thanks. If not, please do so today. Because it has been sent to only a small, but representative, sample of Florida organizations it is extremely important that yours also be included in the study if the results are to be accurate.

If by some chance you did not receive the questionnaire, or it got misplaced, please call us right now (904-646-2783) and we will put another one in the mail to you today.

Thank you for your help.

Steven K. Paulson
Robert C. Pickhardt
Project Co-directors

APPENDIX IV

EMPIRICAL STUDIES AND LITERATURE REVIEWS OF TAX AND OTHER FISCAL INCENTIVES

EMPIRICAL STUDIES

Author	Date	Findings	Reference Information
Adams, Lewison, and Rucks Survey of 170 snowbelt firms	1979	Found state and local inducements (tax levels, tax exemptions, tax credits, financial assistance schemes, laws affecting industry and special services for industrial development) to be far less important than labor, transportation, market, supply, and energy factors.	Pluta (1980): Jack E. Adams, Dale M. Lewison, Conway T. Rucks, "Public Industrial location Inducements: Snowbelt-Sunbelt References," Review of Regional Economics and Business, 4, no. 2, (October 1979): pp. 33-40
Alabama Business Research Council (Study of 54 firms financed by industrial development bonds to evaluate effectiveness of IDB's in attracting business.)	1970	1/3 of firms stated they would not have located in Alabama had the IDB not been offered there, but 90% of total firms offered the funding declined and chose conventional financing instead.	Aulde (1980): Alabama Business Research Council, Industrial Development Bond Financing: Business and Community Experience and Opinions, (Tuscaloosa, Ala.: Univ. of Alabama Press, 1970)

Author	Date	Findings	Reference Information
Apilado (five-year study to determine whether companies would have located or expanded in Michigan without the aid of IDB)	1971	Almost without execption the businesses would have made commitments similar to the ones they undertook with the aid of public funds and, in many cases, induced communities to compete with one another. Overall conclusion: from the community viewpoint the benefits of IDBs are not very great.	Cornia, et al. (1978): Vincent P. Apilado, "Corporate Government Interplay: The Era of Industrial Aid Finance," Urban Affairs Quarterly 7 (December 1971): pp. 219-41
Bergin and Eagen (Survey of 1200 firms recently established in the South)	1961	Tax levels had only a minor impact on the location decisions of the businesses studied.	Aulde (1980): Thomas P. Bergin and William F. Eagen, "Economic Growth and Community Facilities," Municipal Finance 33 (May 1961): pp. 146-50
C.C. Bloom (Interstate comparison)	1939-53	No significant correlation between per-capita state and local taxes and state industrial employment and/or capital outlays on manufacturing.	Cornia, et al. (1978): C.C. Bloom, State and Local Tax Differentials (Iowa City; Bureau of Business Research, 1955)
Escott (Survey of Texas firms to discover major reasons for locating plants in the state from 1955 to 1963)	1964	Major factors were availability of raw materials, expansion of and proximity to markets, an adequate labor supply, adequate and relatively low-cost transportation, and the availability of water and utility services. Taxes were the ninth factor, with emphasis on tax structure equity and no state income tax.	Pluta (1980): Florence Escott, Texas Plant Location Survey 1955-1963 (Austin: Bureau of Business Research, University of Texas, 1964)

Author	Date	Findings	Reference Information
Falk, Hellman, Loeb and Wassall	No date given	Showed that financial incentive programs also provide a less costly inducement to industry than property tax exemption	Cornia, et al. (1978): Lawrence H. Falk, Daryl Hellman, Peter D. Loeb, and Gregory H. Wassall, An Industrial Inducement Program for New Jersey (New Brunswick: Rutgers University Bureau of Economic Research)
Fantus Company (A consulting firm study of business climate in all fifty states)	1975	Concluded Texas offered the most attractive business environment and among the major factors in favor of Texas were low state and local taxes.	Pluta (1980): Bernard L. Weinstein and Robert E. Firestine, Regional Growth and Decline in the United States: The Rise of the Sunbelt and the Decline of the Northeast (New York: Praeger, 1978), p. 136
Fla. Dpt. of Commerce (Study showing the impact of state and local taxes on the profitability of a hypothetical new business)	1978	Comparison suggests that while Florida does not have the lowest state and local tax structure, it is competitive with the other Southeastern states.	B. Tuckman (1979): Florida Department of Commerce, Div. of Economic Development, Bur. of Economic Analysis, "Interstate Comparison of Business Tax Impact on a Manufacturing Firm," Tallahassee, 1978

Author	Date	Findings	Reference Information
Gold Study to appraise the effects of Pennsylvania's industrial revenue bond program	1966	Gold found a positive correlation between volume of bonds issued and the growth in employment at state and county levels, but was unable to conclude that loan programs are beneficial, as they are much more likely to attract small businesses (less than $500,000 net worth).	Aulde (1980): Ronald B. Gold, "Subsidies to Industries in Pennsylvania," National Tax Journal 19 (September 1966): p. 296
Hellman, Wassall, and Eskowitz (Tested to determine the amount of investment that is induced by three types of state incentive programs)	1973	Found state loan and revenue bond programs to be effective in inducing investment within the state. The loan guarantee program was found to have no measurable effect on investment. Found a distinct trade-off between the ability of new investment to curb local unemployment and the industry's growth potential. Companies attracted by fiscal incentives tended to employ low-skill labor and were likely to be declining nationally.	Cornia, et al. (1978): Daryl Hellman, Gregory H. Wassall, and Herb Eskowitz, "The Role of Statewide Industrial Incentive Programs in the New England Economy," New England Journal of Business and Economy 1 (Spring 1973): pp. 10-29
Hunker and Wright (Study of location decisions of 545 Ohio Firms)	1963	Tax structure ranked 14th among 18 location factors. Only 8 of 545 firms surveyed mentioned taxes as a consideration in their location decisions. Only 3 cited tax structure as the most important consideration.	Cornia, et al. (1978): Henry L. Hunker and Alfred J. Wright, Factors of Industrial Location in Ohio (Columbus: The Ohio State University Bureau of Business Research, 1963)

Author	Date	Findings	Reference Information
Jones and Halko Survey of 89 Tennessee firms	1979	Found minimal role for taxes in industrial location decisions.	Pluta (1980): J. Richard Jones and Terry J. Halko, "A Retrospective Look at Plant Location Factors by Firms locating in Tennessee from 1974 to 1976." Mid-South Quarterly Business Review 18, no. 2 (July 1979): pp. 8-12
International Planning Management Corporation (Survey to provide evidence concerning impact of various incentives which The Federal Government might use to increase the application and use of science and technology in the civil sector)	1974	The accelerated depreciation of R&D equipment would tend to increase R&D investment. Further tax concessions are unlikely to stimulate R&D because many projects can be undertaken without this incentive.	George C. Sponsler (1977a).

Author	Date	Findings	Reference Information
Mandell Survey of businesses leaving Detroit	1975 (published)	Major reasons for leaving -- high wage rates. Other factors included high taxes, inadequate labor skills and supply, powerful labor unions, and cirme. Study could not conclusively identify any single factor.	Lewis Mandell (1975).
Martin and Murray Survey of 98 Mississippi firms	1979	Found minimal role for taxes in industrial location decisions.	Pluta (1980): Robert J. Martin and Steve W. Murray, "Why out-of-State Firms Located in Mississippi," Mississippi Business Review 16, no. 3 (September 1979): pp. 3-9
Mueller and Morgan	1962	For firms considering relocation labor costs ranked first, with taxes a strong second. When firms not relocating are included, taxes dropped to fifth, behind labor costs, market, availability of labor, and industrial climate.	Aulde (1980): Eve Mueller and James N. Morgan, "Location Decisions of Manufacturers," American Economic Review, Papers and Proceedings of the 74th Annual Meeting 52 (May 1962): pp. 204-17

Author	Date	Findings	Reference Information
Mulkey and Dillman	1976	Confirmed view that subsidies play at best a minor role in industrial location decisions.	Jacobs (1979): David Mulkey and B.L. Dillman, "Location Effects of State and Local Industrial Development Subsidies," Growth and Change, April 1976, p. 43
National Tax Association (Survey by a special committee of 90 "informed observers" in 16 eastern and midwestern industrial states. Respondents included state and local tax officials, corporation tax managers, private tax practitioners, scholars, and executives of taxpayer organizations).	1967	"Property tax differentials or exemptions have little, if any, regional attraction for industrial locations; it is only when the selection process has been narrowed to a few communities within an area that property taxes may make a difference for some firms." The committee stressed need for policymakers to give greater attention to some of the nontax factors.	Cornia, et al. (1978).
Nishioka and Krumme (Developed a model of the industrial location decision-making process)	1973	"Subsidies are at best marginal considerations which come into play at the end of a long and complex analysis."	Jacobs (1979): Hsiao Nishioka and Gunter Krumme, "Location Conditions, Factors and Decisions: An Evaluation of Selected Location Surveys," Land Economics, 1973

Author	Date	Findings	Reference Information
Pollard and Monti	1978	Taxes were cited as a major criterion by only 4 of 206 firms surveyed--about 2% of the total. Of much greater importance: Labor considerations, existing buildings, low transportation costs.	Pluta (1980): Robert F. Pollard and Lorna A. Monti, "Industrial Location Decisions in Texas," *Texas Business Review*, July 1978, pp. 125-27
Quante (Questionnaire and interview study to determine why Fortune 500 companies in New York City were moving to the suburbs and other cities)	1976	Failed to find any relocation move in which taxes were the dominant consideration. Crime, insufficient labor supply, commuter time, and high rents were all weighted heavier than taxes.	Cornia,et al. (1978): Wolfgang Quante, *The Exodus of Corporate Headquarters from New York City* (New York: Praeger Publishers, 1976)
Quindry and Bayer Tennessee study of state tax policies	1977	State tax policies had little direct impact on location decisions. It found important factors promoting general economic development to be strengthening public education; improving railroad systems; exempting manufacturing inventories and machines from property tax; exempting new machinery and equipment from sales tax; and equalizing the tax burden.	Pluta (1980): Kenneth E. Quindry and Arthur A. Bayer, A Comparative Business and Industry Tax Study for Tennessee (Nashville: The Tennessee Department of Economic and Community Development and Tennessee State Planning Office, 1977)

Author	Date	Findings	Reference Information
Schmenner A report for the Commerce Department	1978	Evidence indicates that the decision to expand is based on factors internal to the firm, primarily the need for space and introduction of new technology, and is unlikely to be affected by the availability of incentives.	Jacobs (1979): Roger Schmenner, The Manufacturing Location Decision Evidence from Cincinnati and New England, Economic Development Research Report, Department of Commerce, 1978, p. 3-1
Stober and Falk	1967	Property tax exemptions were inefficient in the sense that Louisiana could have provided an equal cost savings to recipient industry at a lesser expense to the state. Direct cash grants were found to be more efficient than property tax exemptions because businesses discount the future at a greater rate than government and because state and local taxes are deductible in computing income for federal tax purposes.	Cornia, et al. (1978): William J. Stober and Lawrence H. Falk, "Property Tax Exemption: An Inefficient Subsidy to Industry," National Tax Journal 20 (December 1967): p. 386
Stober and Falk Constructed an analytical model to calculate the effect of financial incentives on industry costs	1969	Revenue bond financing was found to be the most effective inducement to industrial location. Financial incentives have the greatest impact on capital-intensive industry and not upon mobile, labor-intensive industry.	Cornia, et al. (1978): William J. Stober and Lawrence H. Falk, "The Effect of Financial Inducements on the location of Firms, " Southern Economic Journal 36 (July 1969): p. 25

Author	Date	Findings	Reference Information
Struyk Tested hypothesia that low-tax cities grow faster than high-tax cities	1967	The study of 50 American cities found some correlation between the variables, but the results were far from conclusive and provided only a partial explanation of economic growth.	Aulde (1980): Raymond J. Struyk, "An Analysis of Tax Structure, Public Service Levels, and Regional Economic Growth," Journal of Regional Science 7 (Winter 1967): pp. 175-78
Texas Legislature Senate Subcommittee	1971	Concluded only 12 percent of companies surveyed nationally had permitted tax factors of any kind to affect their location decisions."	Pluta (1980): A Consumer Viewpoint of State Taxation: An Analysis of Alternative Tax Proposals for the 62nd Legislature (Austin: Texas Legislature, Senate, 1971), p. 27
Turner and Inzer (Replication of the Department of Commerce study with the site locations changed and number of hypothetical industries increased)	Subsequent to 1978 Study	Results suggest that taxes have a relatively small effect on the profitability of a firm in the southeastern states considered.	B. Tuckman (1979): Robert G. Turner and Robert B. Inzer, "The Impact of State and Local Taxes upon Expected Profits of Manufacturing Firms," Florida House of Representatives, Committee on Tourism and Economic Development, Tallahassee

Author	Date	Findings	Reference Information
U.S. Advisory Commission Study to confirm earlier survey findings	1967	Location decisions were made primarily on the basis of economic factors not connected with taxes, while tax differentials among states were relatively unimportant.	Pluta (1980): U.S. Advisory Commission on Intergovernmental Relations, State-Local Taxation and Industrial Location (Washington, D.C.: Advisory Commission, 1967), p. 49
Williamson (Survey of Southwestern firms)	1969	Only 4% of firms receiving industrial development bonds considered them crucial to their decision to locate within the state.	Jacobs (1979): Robert Williamson, "Some Evidence in Support of State Industrial Financing Programs: The Southwestern Case," Land Economics, 1969, pp. 388-92
Wisconsin Department of Revenue	1975	"... no clear cut relationship between the level of business taxes and manufacturing employment growth rates for states within the same region ..." The study attributed the lack of relationship largely to the similarity in tax policies and rates among adjacent states."	Cornia, et al. (1978): Wisconsin Dept. of Revenue, Corporate Tax Climate: A Comparison of 15 States (Madison: Wisconsin Department of Revenue, December 1975)

REVIEWS OF LITERATURE

Author	Conclusions	Reference Information
Advisory Commission on Intergovernmental Relations	Tax considerations do not figure prominently in the selection of a region or area. The choice typically depends on raw material, market, and labor factors. The A.C.I.R. has repeatedly warned against excessive and destructive interstate tax competition.	Jacobs (1979): Advisory Commission on Intergovernmental Relations, State-Local Taxation and Industrial Location, 1967, p. 63
Andrew J. Aulde (Analysis of fiscal incentives as a means to promote industrial development)	Summary of Aulde's literature review reflects the concensus of most observers that relatively high business taxes and availability of low-cost financing play minor roles in industrial location decisions. Implications of Aulde's research, while not conclusive, indicate that fiscal subsidies, tax concessions, and special services for industry have little impact on interstate and interregional industrial location choices.	Aulde (1979).
Gary C. Cornia, William A. Testa, and Frederick D. Stocker	"Despite the unanimity of their negative findings, questionnaire surveys have not conclusively shown whether tax or fiscal concessions influence industrial location. They do indicate that labor costs, markets, and community environment are usually	Cornia, et al. (1978).

(Contd. to next page)

Author		Conclusions	Reference Information
(con'd)		more important to the decision process than the level of taxes. In some situations, however, tax considerations are influential." Questionnaires using a more direct question tend to suggest substantial weight of the role of taxes in the location decision. When the question is asked in a less direct fashion, results tend to suggest little or no tax influence.	
John F. Due	1961	"While the statistical analysis and study of location factors are not conclusive, they strongly suggest that tax effects cannot be of major importance."	Pluta (1980): John F. Due, "Studies of State-Local Tax Influences on Location of Industry," National Tax Journal 14, no. 2 (1961): 163-73.
Jack Faucett Associates Survey	1976	Corporate income tax subsidies are especially inefficient as financial incentives. There is little evidence that they are a critical factor in plant location decisions.	Jacobs (1979): Jack Faucett Associates, Effectiveness of Financial Incentives on Investment in the Economic Development Administration's Designated Areas, Economic Development Administration, U.S. Department of Commerce, June 1976, pp.i-iii

Author		Conclusions	Reference Information
Jerry Jacobs Review and examination of the efforts of states and localities to attract business	1979	Most states offer most standard types of business location incentives. There is little evidence to suggest that tax subsidies are relevant factors in corporate decisions either to relocate from one state to another or to increase investments and jobs in already-existing plants. State taxes are much lower (no more than 12%) and the impact is further reduced by fact that state taxes can be deducted as a business expense from federal taxes.	Jacobs (1979).
Joseph E. Pluta		Pluta's literature survey suggests that taxes play only a limited role in the majority of business location decisions.	Pluta (1980).
Barbara H. Tuckman		Tuckman's literature review offers concensus that taxes play a minor role in location decisions.	Tuckman (1979).

Author	Conclusions	Reference Information
Leonard F. Wheat	In 1973, Wheat reviewed numerous statistical studies on economic growth. Wheat wrote, "This [the tax hypothesis] is perhaps the most tested of hypotheses. And the results of prior testing do not encourage further tests."	Cornia, et al. (1978): Leonard F. Wheat Regional Growth and Industrial Location: An Empirical Viewpoint (Lexington, Mass.: Lexington Books, 1973), p. 29

APPENDIX V

KEY FLORIDA AND FEDERAL LEGISLATION FOR JOINT UNIVERSITY-BUSINESS RESEARCH

KEY FLORIDA STATUTES

(Based on Jaski, 1982 and Florida Bureau of Economic Analysis, 1982)

1. Chapter 240, Part II, creates the powers and duties of the Board of Regents as well as those of the universities. Thus, particularly as of 1979, Chapter 240.227, delegates to the universities a number of day-to-day powers. For example, universities are authorized to provide for compensation and other conditions of employment for university personnel; approve and execute contracts for goods, equipment, services, leases, and construction up to $500,000; manage the property and financial resources of the university.

2. Chapter 240.229, empowers the universities to secure, license, enforce and otherwise do everything necessary to the establishment and administrator of patents, copyrights and trademarks.

3. Chapter 240-241, creates and authorizes Divisions of Sponsored Research at the State universities whose essential function is that typically of administering and promoting programs of research, contracts and grants.

4. Under Chapter 240.223, the Board of Regents is empowered to act as trustee of any funds or real or personal property in which any of the institutions under its supervision or their employ may be interested as beneficiary or otherwise for any educational purpose.

5. Chapter 240.299 creates university direct support organizations which are essentially to be non-profit Florida corporations organized and operated exclusively to receive, hold, and invest and administer property and to make expenditures to or for the benefit of a State university. Such an approved direct support organization is authorized under appropriate Board of Regents rules to use property, facilities, and personal service at such State university.

6. Article 7, Section 10 of the Florida Constitution - "no state . . . agency may enter into a joint venture nor pledge credit for the benefit of a private entity." A variety of case interpretations conclude that the key issue to be resolved is whether such as activity is compelled by a paramount public purpose. (State Department of Transportation v. Chadbourne, 358 So. 2d 605 1st DCA 1978; The City of West Palm Beach v. Williams, 291 So. 2d 572, Sup. Ct., 1974).

7. Statute 112.313, dictates the parameters of conflict of interest of State employees. Certain exemptions exist that permit employees doing business with their own agency under specific conditions.

8. Section 240.257 which provides for establishment by the Board of Regents, on recommendation of a State University System university president, of endowed chairs for eminent scholars. Provision is made for establishment of a trust fund in the amount of $1,000,000 for each such chair with the Board matching $600,000 of private funds with $400,000 in each case. This program provides a channel for industry and other private sector contributions directly to the development of exceptionally strong technological staff capabilities.

9. Chapter 78-402 (F.S. 23: 145-23.149) established the Florida Research and Development Commission - which is responsible for approving and promoting research development parks.

10. Chapter 159, which deals generally with industrial revenue bonds, makes provision for the use of such financing methods to develop research and development parks--a form of industrial park devoted exclusively to research and development related activities.

11. Chapter 80-249, Community Improvement Act of 1980 - established procedure through which businesses may receive a 50 percent tax credit of their contribution to eligible community development projects. (limit $200,000 annually)

12. Florida Industrial Development Financing Act, 1981 - authorized issuance and sale by local governmental body of revenue bonds to finance or refinance the cost of capital projects for industrial or manufacturing plants.

13. Chapter 82-13, provides for exemption of trade secrets and similar information in connection with universities from the Public Records Law. Prior to its passage, trade secrets and patentable ideas in the hands of university staff were considered public documents open to inspection to anyone.

14. Chapter 82-137, increased short term limit on leases of university land permissible under current provisions of Section 243.151, from 40 to 99 years or the life expectancy of the permanent facilities constructed thereon, whichever is shorter.

KEY FEDERAL LEGISLATION

(Based in part on: Florida Department of Commerce, 1982;
U.S. Congress, 1979d; Federal Legislative Calendars)

1. Amendments to N.S.F. Act

   1968 - gave the N.S.F. the authority to support certain kinds of applied research at academic and nonprofit institutions, as well as the authority to support research at profit making organizations, provided the research was directed at a national need and entailed research goals authorized directly by the president.

   1976 - Congress required for first time that 7.5% of money available to NSF's Research Applications Directorate be obligated to small business. This was increased to 12.5% in 1978.

   1977 Authorization Act - mandated N.S.F. to establish an Office of Small Business Research and Development.

   1978 - The National Science Board approved a change in N.S.F. policy authorizing expanded funding of the Foundations cooperative industry-university research projects.

2. Stevenson-Wydler Technology Innovation Act, 1980. The main purpose of the Stevenson-Wydler Technology Innovations Act was to create federally assisted "centers for industrial technology."

3. Engineering and Science Manpower Act, 1982. These bills introduced during the 97th Congress, did not pass before adjournment in December, 1982.

   H.R. 5254 - Bill introduced providing a national policy for engineering, technical and scientific manpower, to create a national coordinating council on Engineering and Scientific Manpower, and for other purposes. H.R. 5254 was superseded by H.R. 7130.

   H.R. 7130 - In addition to provisions of its predecessor H.R. 5254, H.R. 7130 provided for cost-sharing by the private sector in training such manpower.

4. National Technical Foundation Act, 1980 - establishes a National Technology Foundation (NTF).

   H.R. 6910 did not pass before adjournment of the 96th Congress.

5. Small Business Innovation and Research Act of 1982. This law establishes a mandatory set-aside of a percentage of each agency's research and development budget to be used by small businesses.

6. University and Small Business Patent Procedures Act (P.L. 96-517). This act provides for uniform assignment to universities, small businesses and nonprofit organizations of title to inventions developed under Federal research and development grants and contracts.

   The number of universities with formed mechanisms for handling inventions is steadily growing. Due to the unfortunate fact that the majority of Federally funded R&D goes to large business which are not governed by P.L. 96-517, new legislation for a uniform patent policy was introduced during the 97th Congress.

7. Joint hearings were held on the following proposed bills which entitled the Uniform Science and Technology Research and Development Utilization Act.

   S. 1657 - assigns to the Commerce Department patent policy implementation responsibilities in cooperation with the Office of Federal Procurement Policy.

   H.R. 4564 - assigns patent policy implementation to the Federal Coordinating Council for Science, Engineering and Technology.

   Both bills included a provision limiting Federal acquisition of patent rights, allowing contractors and inventors to retain rights in most cases. The bills were designed so that the U.S. patent system will be an incentive encouraging private investment. Neither bill passed before the adjournment of 97th Congress on December 21, 1982.

8. Economic Recovery Tax Act, 1981. The ERTA included specific provisions which are intended to provide incentives for businesses to increase research and development expenditures.

   25% tax credit for certain qualified research and development costs paid or incurred prior to 1986.

   The regulations defined "qualified research and experimental expenditures" to mean "research and development costs in the experimental or laboratory sense."

   Research expenditures must be distinguished from related expenditures not constituting research. For contract research, 65% of the contract payments are treated as research.

   Only the taxpayer who makes payments under the contract and on whose behalf the research is conducted can claim the credit. "This rule appears to be designed to preclude the research firm, university or other person conducting the research on behalf of the taxpayer from claiming the credit for its expenditures in performing the contract."

Three types of research organizations are eligible - colleges and universities, scientific research organizations, and research foundations.

Only colleges and universities can qualify as recipients of payments for basic research. The amount must be paid or incurred pursuant to a written research agreement between the corporation and the college or university. The educational organization must meet certain standards to be eligible.

Basic research is defined as "any original investigation for the advancement of scientific knowledge not have a specific commercial objective."

Basic research conducted outside the U.S. is specifically ineligible.

Basic research in the social sciences and humanities is ineligible.

The ERTA of 1981 also increased the corporate charitable deduction limit from 5% to 10% of corporate income.

9. Legislation Activity, 98th Congress Bills which have passed either or both houses, and bills now pending on the calendars.

H.R. 861 (S. 273) - Small Business Pilot Procurement Programs.

H.R. 1043 (S. 272) - Small Business access to procurement information and contracting opportunities.

H.R. 1310 (H. Res. 109) - Mathematics and Science Education Act.

APPENDIX VI

ILLUSTRATIVE PROTECTIVE AGREEMENT FOR JOINT RESEARCH CONDUCTED BY FLORIDA UNIVERSITIES AND BUSINESS FIRMS

Statement of Agreement of Research Disclosure Policy and Review Procedures

Florida Widget Company

and

The University of North Florida

I. Preamble

The purpose of this statement is to provide a basis for assuring the confidentiality of data and anonymity in publications resulting from a study which involves the Florida Widget Company (FWC), as the research site, and the University of North Florida (UNF), as the research unit. The primary mission of a university is to provide a focus for the growth of ideas. Since ideas develop in the minds of people, communication between scholars, faculty, and students -- in short, teaching -- is the first basic function of a university. But, without ideas to communicate, teaching is an exercise of futility. Therefore, the second basic function of a university must be research, characterized by the spirit of free inquiry and the exploration and synthesis of ideas. The university shall set policies to effectuate the purposes of the research programs in a manner which assures efficiency and effectiveness, producing the maximum benefit for the educational programs and maximum service to the State of Florida. To this end the 1982 Session of Legislature amended Florida Statutes, Chapter 240.241 to provide an exemption to the provisions of F.S., Chapter 119, when dealing with business transactions or proprietary information. Specifically it is agreed that the following procedures will be adhered to without exception.

II. Data Confidentiality

1. All information which is collected in the course of the study ("raw data") will be identified only by pseudonyms or numbers which are unrelated to the true identity of the information. The true name of the company, its departments, product lines and personnel will not be associated with the raw data records and files.

2. Publically available information about the company will not be associated with raw data records and files. When such information is used in analysis it will conform to the restrictions in 1. above.

3. The raw data will not be provided to other organizations or individuals for any purpose.

4. The nature of the raw data and the method of collection will be clearly indicated to company officials.

III. Publication Anonymity

1. Except for a confidential research summary which will be prepared for the company, all publications resulting from the study will conform to the following standards:

   a. The company name or an identifiable pseudonym will not appear on the manuscript.

   b. company technology, products and material inputs will not be identified except in vague terms as, for example, "continuous process fabrication of plastic into intermediate industrial products with resulting batches of 1,000 to 4,000 lbs."

   c. geographical identification of the firm will not be more specific than "southern U.S."

   d. site description will be restricted to vague phrases such as "two manufacturing locations situated within 100 miles of one another; one of recent construction in a rural setting and the other of older construction in a metropolitan area."

   e. data will be presented in coded and statistical summary fashion so that the raw data values cannot be reconstructed.

2. The research unit will provide FWC with review copies of manuscripts which have been scheduled for publication.

3. No manuscript may be published unless FWC indicates written approval. Such approval will be contingent and forthcoming upon meeting of all of the manuscript standards listed in III.1 above and within two weeks of submitting the manuscript for review.

The undersigned agree to conduct the research and to permit the research to be conducted in accordance with the items of this statement and the general guidelines in the Research Proposal, a copy of which is attached.

Vice-President, FWC

Study Director and Professor, UNF

Personnel Director, FWC

Director of Sponsored Research, UNF

Plant Manager, FWC

Vice-President of Administration, UNF

APPENDIX VII

ILLUSTRATIONS OF TYPES OF OPERATING JOINT BUSINESS-UNIVERSITY RESEARCH PROGRAMS

Source of Information: The programs discribed in this appendix are based on one or more of the following references: Azaroff (1972); Boykin (1980); Burger et al (1979); Ekwar (1979); Florida Bureau of Economic Analysis (1982); Hamilton (1980); Kapany (1978); Keyworth (1982); Kohorn (1979); Landis (1977); National Governors's Association (1982); Prager and Omenn (1980); U.S. Congress (1979d); Western Interstate Commission for Higher Education (1981).

Category/Organization-Program

I. Broad Sponsorship:

A. Undirected corporate contributions and grants:

The Monsanto Fund makes a large number of undirected donations to universities.

Recent decision by Exxon Foundation to offer $15 million to 66 colleges to support 100 new doctoral candidates

B. Capital contributions-gifts to specific departments, centers, or laboratories:

State University of New York at Stony Brook and General Instrument Corporation-The GI company provides annual renewable funding for a graduate fellowship and research funding specifically for a professor in VLSI system architecture, plus donations of equipment.

C. Industrial fellowships-contributions to specific departments, centers, laboratories as fellowships' for graduate programs:

Monsanto's $500,000 Toxicology Fellowships for training of graduate toxicologists

Monsanto's graduate student summer program, whereby they employ students in specific disciplines from certain institutions.

II. University Affiliates and Industrial Consortia Programs

A. Industrial associates: single university; usually multiple companies; industry pays fee to the university for right of being treated as a privileged associate with access to resources of the university. This type of regular interaction is common among high-technology universities with strong science and engineering facilities. Best known and most highly developed examples:

MIT Industrial Liasion Program ILP
This is the oldest program in the country linking industry representatives directly to university faculty members. It functions to assist in initiating and maintaining an exchange of information. There are approximately 186 member companies.

MIT Associates Program was established in 1961 to provide access to MIT by firms whose interests are less extensive in scope. It now links an additional 48 firms to the institute. Members pay a flat fee to MIT which entitles them to a variety of services all of which are designed to provide companies with easy access to the "state of the art" in MIT laboratories and classrooms.

Cornell Program on Submicron Structures
$300,000 total in cash and/or grant memberships - member companies include G.E., I.B.M., Sperry Rand Corp., Texas Instruments, Xerox, Intel Corporation.

California Institute of Technology
Has developed several industrial associates programs - Begun in 1978 the Silicon Structures Program has a budget of slightly more than $250,000 per year. Seven member companies contribute $100,00 annually. The remaining $500,000 goes towards purchase of equipment and use of campus facilities.

Center for Microelectronics and Information Sciences
Recently initiated at the University of Minnesota with two members, Control Data Corporation and Honeywell, Inc., each contributing approximately $2 million.

Rensselaer Polytechnic Institute/General Electric, Boeing, General Motors The three companies provided $1 million in seed money to start the Center for Manufacturing Productivity and Technology Transfer. Companies utilizing the facilities are charged for the center's work - mainly solving application problems.

B. Research consortia single university multiple companies; basic and applied research of problems of special interest to an entire industry; members pay a fee and all members share the results of the research:

Carnegie-Mellon Processing Research Institute

University of Delaware Catalysis Center

North Carolina State Furniture Institute

Cornell Injection Molding Project

Penn. State Univ/Non Metallics

Lehigh Univ/Metals

Case Western Reserve University/Polymers

Stanford University/Chemistry-Chemical Engineering Program

MIT - Industry Polymer Processing Program

III. Procurement of services from industry by university:

A. Student Coop Programs -

B. Consulting Services
General Electric - consultants regularly visit G.E. There is a changing role of consultants from 10-15 years ago, at which time consultants put out technical fires. They now help in developing the scenario of what the scientific world and industrial activity will be in five-ten years.

C. Research Partnerships: Joint planning, implementation, and evaluation of significantly long term research program of mutual interest and benefit. Contractual arrangement; both parties contributing substantively. The industrial partner is a large firm with a highly developed research program. The university partner is a large stable, productive basic research group.

The Harvard and Monsanto partnership is one of the best known and longest in duration.

D. Illustrative Engineering Research Programs

Georgia Technology Research Institute
Research for private firms is contracted through the Georgia

Technology Research Institute and subcontracted to Georgia Tech. The Institute is a nonprofit private corporation, chartered by the Georgia Institute of Technology, and administered by a Board of Directors, consisting of 12 members; 4 each from Georgia Tech, Georgia Tech Alumni, and industry.

Harvey Mudd College
Electrical Engineering students obtain contracts from local companies and are evaluated on their ability to perform, based on the contract.

Stanford Research Institute (SRI International)
Spinoff of Stanford University; private, nonprofit organization. Board of Directors mostly consists of heads of companies. Performs research on contract basis for government and private firms.

Mining and Mineral resources Research Institute, University of Washington
The Institute is governed by a 7 member policy board, 4 members from the Univ. of Washington, 2 from Washington State University, 1 from Eastern Washington University. Services include technical assistance, reference services and training to state and federal government, citizen groups, and private firms. Funding is 50% state and 50% federal.

III. Collaboration

A. Cooperative Research Programs

1. Independent Collaboration Research Projects: University and industry scientists cooperate on project of mutual interest; usually basic nonproprietary research; publications are common and encouraged. The peer collaboration is possible only when the industry partner has significant in-house research capability, which is characteristic of only a few major corporations. Bell Laboratories maintains a number of individual scientific and technical arrangements with universities around the country. The research is generally basic science and engineering; not proprietary; scientist-to-scientist interactions working on topics of common interest. (jointly funded)

2. Government Supported Cooperative research programs - Industry support supplements funding by university, private foundation, and government; results are of special interest to the company involved:

a. State Govenment supported illustrations:

Bell Laboratories and Lehigh University (research of thermal convection in cavities).

California Institute of Technology/Several Computer Firms (design of silicon structures).

Eastman Kodak and Clarkson College of Technology (research of crystal formation in surfactant solutions).

Artisan Industries and the University of Houston (research on the fundamental mechanics of a filtration process).

Micro Electronics Innovation & Computer Science Research Opportunities (MICRO) Program

b. National Science Foundation Experimental R&D Incentives Program illustrations

i. University-Industry Cooperative Research Centers

This program encourages institutional arrangements, between university and industrial communities, to stimulate scientific research and technological innovation.

This program has funded three experimental centers:

Funrniture R&D Application Institute, North Carolina State University

New England Energy Development Systems, MITRE Corporation.

MIT Polymer Processing Program

ii. Centers for Innovation and Entrepreneurial Development

This program is aimed more toward basic research for product & process development. Four centers are currently operative:

Carnegie-Mellon
MIT
University of Oregon
University of Washington

c. National Science Foundation Industry-University Cooperative Projects

NSF began highlighting this program in 1978 to support individual projects carried out jointly by academic and industrial researchers. Projects are investigator-initiated.

The following is a selected list of active grants in FY 1979.

PROGRAM	UNIVERSITY	INDUSTRY
Fluid Mechanics	Georgia Inst. Tech.	Lockheed
Fluid Mechanics	U. Pittsburgh	Westinghouse R&D Center
Particulate & Multiphase Proc.	U. Houston	Artisan Ind.
Engineering Energetics	SUNY/Buffalo	Calspan Corp.
Thermodynamics & Mass Transfer	CUNY/Brooklyn	Union Carbide
Chemical Processes	Polytech Inst. NY	Allied
Heat Transfer	Oregon State	Drew Chemical
Chemical Processes	U. Delaware	DuPont
Solid State & Microstructures	U. Florida	Harris Semiconductor
Quantum Electronics, Waves & Beams	U. Florida	Exxon
Heat Transfer	Lehigh Univ.	Bell Labs
Electrical & Optical Comm.	U. Rhode Island	Raytheon

d. Department of Energy

The DOE has stimulated university-industry-government cooperation in R&D related to specific energy technologies.

(1) DOE's SERI-Solar Energy Research Institutes

Commercialization centers located in Georgia, Oregon, Massachusetts, and Minnesota.

(2) DOE's National Laboratories

Approximately 60 laboratories which differ in management and function; 12 are multi program, government-owned and contractor-operated (either university or private industry)

These institutions were initiated to address questions of R&D which industry (with its profit motive) or universities (with their educational mission) cannot or should not address.

e. United States Department of Agricultural

Cooperative State Research and Extension Services are funded through Federal, state and local governments, and grants from government and industry. This program has evolved over the past 125 years into a very effective system for technological transfer in the agricultural industry.

APPENDIX VIII

CONVERSATION GUIDELINES FOR UNIVERSITY-INDUSTRY RESEARCH PROJECT CONTACTS

INTRODUCTION: STAR Grant (original focus tax credit, now general)
In conjunction with Gov Off
What have done: read
What will do: talk, survey, write
Related areas: innovation, hi-tech, hi-education

WHAT HAS BEEN DONE IN STATE TO ENCOURAGE REL'N? ELESWHERE? (ATTACHED)

WHAT SHOULD BE DONE? WITH FLORIDA INDUSTRIES? WITH ATTACHED INDUSTRIES? (ATTACHED)

WHAT IS THE LIKLIHOOD OF SUCH REL'NS? BY SMALL BUSINESSES? BY RESEARCH FIRMS? (ATTACHED)

WHO ELSE SHOULD WE TALK WITH ABOUT THIS SUBJECT? WHY? (ATTACHED)

ALSO: WHAT IS THE NATURE OF THIS ORGANIZATION? (UNDER "OTHER" BELOW)

HOW LONG BEEN IN JOB? FIELD? (UNDER "OTHER" BELOW)

CONTACT DETAIL

NAME____________________ Address ____________________

Title____________________ Phone____________________

Time____________________

OTHER INFORMATION

WHAT HAS BEEN DONE IN THE STATE TO ENCOURAGE REL'N? ELSEWHERE?

WHAT SHOULD BE DONE? WITH FLORIDA INDUSTRIES? WITH ATTRACTED INDUSTRIES?

WHAT IS THE LIKLIHOOD OF SUCH REL'NS? BY SMALL BUSINESSES? BY RESEARCH FIRMS?

WHO ELSE SHOULD WE TALK WITH ABOUT THIS SUBJECT? WHY?

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